

# MUD SHRIMPS, *UPOGEBIA*, FROM THE EASTERN PACIFIC (THALASSINOIDEA: UPOGEBIIDAE)

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## SYNOPSIS

The mud shrimp genus *Upogebia* found in the eastern Pacific between Alaska and the Galapagos Islands is reviewed. Four previously described species from this region are recognized: *U. longipollex* (Streets) and *spinigera* (Smith) ranging from El Salvador to Ecuador; *pugettensis* (Dana), from Valdez, Alaska to Morro Bay, California; *rugosa* (Lockington), Gulf of California; and a fifth species from the western Atlantic, *affinis* (Say), has been taken once in San Francisco Bay. Fifteen species new to science are described: *U. acanthops*, Panama; *burkenroadi*, Sonora, Mexico; *dawsoni*, Gulf of California to Panama; *galapagensis*, Galapagos Islands; *jonesi*, Sonora, Mexico, to Panama; *lepta*, islands off southern California; *macruryae*, El Salvador to Ecuador; *macginitieorum*, southern California bight; *onichion*, San Miguel Island off southern California; *schmitti*, Panama; *tenuipollex*, Ecuador; *thistlei*, Gulf of California to Ecuador; *veleronis*, Islas Tres Marias, Mexico, and Cape San Francisco, Ecuador; *ramphula*, Maria Madre Island, Mexico; *cocosia*, Cocos Island. All except *U. affinis* are illustrated. Keys are given for identification of all species of *Upogebia* known from the Western Hemisphere, 7 from the western Atlantic and 19 from the eastern Pacific.

# Mud Shrimps, *Upogebia*, from the Eastern Pacific (Thalassinoidea: Upogebiidae)

Austin B. Williams<sup>1</sup>

## INTRODUCTION

Mud shrimps of the genus *Upogebia* [Leach] in the eastern Pacific scarcely have been touched from a taxonomic point of view. Until now, five species have been recognized from the latitudes of Alaska to Peru. This range of over 9700 kilometers (6000 mi) encompasses seven zoogeographic provinces (Brusca and Wallerstein 1979) influenced by cold temperate to tropical current regimes. The literature concerning *Upogebia* in this region is rather limited. The species described are: *Gebia pugettensis* Dana 1852 (Puget Sound, Washington), redescribed in the genus *Upogebia* by Stevens (1928) and de Man (1929) from specimens collected in British Columbia; *Gebia spinigera* Smith 1871 (Gulf of Fonseca), redescribed in the genus *Upogebia* by Holthuis (1952) from Colombian material; *Gebia longipollex* Streets 1871 (Panama), poorly described, no type-specimens extant, and identity in doubt; *Gebia rugosa* Lockington 1878 (Gulf of California), briefly described, no type-specimens extant, but identity distinctive; and *Upogebia rostrispinosa* Bott 1955 (El Salvador).

De Saint Laurent and Le Loeuff (1979) pointed out the remarkable uniformity in morphology of the family Upogebiidae as a whole. They regarded the family as monogeneric, within which the subgenera recognized by de Man (1928) and others have no systematic value because of overlapping characters, but they continued to recognize certain clusters of taxa in a new attempt to evaluate relationships within the family. They pointed out that about 50 species were known at that time from the Indo-West Pacific, 13 from the eastern Atlantic, and 12 from the western hemisphere. Sakai (1982), in a revision of the Indo-West Pacific members of the family, recognized 45 species from that region. He also emphasized the remarkable uniformity in morphology of the group. However, he subdivided it by placing 40 of the species in the genus *Upogebia*, further split into 3 subgenera, and erected two other genera, *Wol-fogebia*, to contain 4 subspecies having a median

carina on the anterior carapace, and the monotypic *Tuerokayogebia*, lacking lateral ridges on the anterior carapace. Though the richly developed Indo-Pacific fauna would appear to occupy a central position in evolution and dispersal of the family, the seemingly depauperate western Atlantic and eastern Pacific harbor more species than thought heretofore.

The elucidation of relationships within the family as a whole are beyond the scope of this paper, but the suggestions of de Saint Laurent and Le Loeuff (1979) are reinforced by a better understanding of the New World species. Three clusters of species occur in the western hemisphere (Table 1): (1) a large cluster of species with normal abdomen and tail fan but subdivided into a series which lacks a strong proximal spine on the merus of the second leg and another series which possesses this spine, (2) a form related to these that has a distinctive abdomen, and (3) a few species that have developed an opercular tail fan. There are 3 operculate species in the third cluster (1 Atlantic, 2 Pacific), and a single Pacific species with distinctive sixth abdominal segment in the second. All these species lack an epipod on the third maxilliped. The 22 species in the first cluster lack these modifications (6 Atlantic, 16 Pacific); 12 of these have a proximal spine on the merus of the second leg (4 Atlantic, 8 Pacific), 10 lack the meral spine (2 Atlantic, 8 Pacific), and 3 Pacific species in the latter group lack a postorbital spine as well. All of the 16 Pacific species in this first cluster have a rudimentary epipod on the third maxilliped (the Atlantic species remain to be studied).

Mouthparts of species within the genus have a noteworthy similarity, as will be demonstrated with illustrations for representative species selected from the above mentioned groups.

De Saint Laurent and Le Loeuff (1979) regarded the few New World operculate species as forming a link with the tropical Indo-Pacific "Calliadne" element in the genus. The more numerous remaining species are a distinct and relatively homogeneous endemic set, which at this time have an imperfectly understood relationship with the eastern Atlantic elements in the family. Though subgenera of *Upo-*

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TABLE 1. Groupings within the genus *Upogebia* in the western hemisphere. A = western Atlantic distribution, P = eastern Pacific.

|                                                      |                              |
|------------------------------------------------------|------------------------------|
| First cluster; normal abdomen and tail fan           |                              |
| Lacking strong proximal spine on merus of second leg |                              |
| <i>U. annae</i>                                      | Thistle, A                   |
| <i>U. brasiliensis</i>                               | Holthuis, A                  |
| <i>U. burkenroadi</i>                                | new species, P               |
| <i>U. lepta</i>                                      | new species, P               |
| <i>U. macrariae</i>                                  | new species, P               |
| <i>U. macginitieorum</i>                             | new species, P               |
| <i>U. onychion</i>                                   | new species, P               |
| <i>U. pugettensis</i>                                | (Dana), P                    |
| <i>U. tenuipollex</i>                                | new species, P               |
| <i>U. veleronis</i>                                  | new species, P               |
| With strong proximal spine on merus of second leg    |                              |
| <i>U. acanthops</i>                                  | new species, P               |
| <i>U. affinis</i>                                    | (Say), A (P, 1 introduction) |
| <i>U. dawsoni</i>                                    | new species, P               |
| <i>U. galapagensis</i>                               | new species, P               |
| <i>U. jamaicensis</i>                                | Thistle, A                   |
| <i>U. jonesi</i>                                     | new species, P               |
| <i>U. longipollex</i>                                | (Streets), P                 |
| <i>U. noronhensis</i>                                | Fausto-Filho, A              |
| <i>U. omisa</i>                                      | Gomes Correa, A              |
| <i>U. schmitti</i>                                   | new species, P               |
| <i>U. spinigera</i>                                  | (Smith), P                   |
| <i>U. thistlei</i>                                   | new species, P               |
| Second cluster; distinctive sixth abdominal segment  |                              |
| <i>U. ramphula</i>                                   | new species, P               |
| Third cluster; with operculate tail fan              |                              |
| <i>U. cocosia</i>                                    | new species, P               |
| <i>U. operculata</i>                                 | Schmitt, A                   |
| <i>U. rugosa</i>                                     | (Lockington), P              |

*gebia* have proved faulty in the past, Sakai (1982) has again split this unwieldy genus, and it is likely that there will be other subdivisions in the future. I hesitate to initiate such changes for the western hemisphere until at least all the New World species are studied, but it is evident that good distinctions can be made among some species groups. For that reason the sequence of species accounts that follow is not strictly alphabetical but is arranged in the three clusters, the largest first, the single species second, and the operculates last.

The little information that is available on the biology of *Upogebia* species occurring in the eastern Pacific is derived almost exclusively from study of the blue mud shrimp, *U. pugettensis*. That species forms male-female pairs which live in relatively permanent U-shaped burrows, as much as 1 m deep, in anoxic soft muds or clay muds of tidal flats. For example, the burrows in Yaquina Bay, Oregon, are most frequent at lower tide levels. In some regions the substrate can be so honeycombed that water pours into an excavated burrow system almost as fast as mud can be removed. *Upogebia pugettensis* is a menace to young oysters in Puget Sound. The burrows cause leakage from dikes built to keep the

oysters on mud flats covered with water at low tide, and bioturbation from the shrimps' activity smothers spat. The mud shrimps pump water through their burrow systems in order to feed on plankton and suspended detritus (Johnson and Snook 1927; Smith et al. 1954; Ricketts and Calvin 1939, 1948, 1952, 1968; L. C. Thompson and Pritchard 1969; R. K. Thompson and Pritchard 1969; Pritchard and Eddy 1979). So far as known, all members of the genus live in burrow systems, though substrates may vary.

The large region covered in this paper is still relatively unexplored in many of its parts and, therefore, other species of *Upogebia* will undoubtedly be added to those discussed here as studies progress. For example, specimens are not known from Peru southward. Nevertheless, it is evident that the geographic ranges of the species treated (Fig. 1) conform reasonably well with shallow water zoogeographic provinces of the northeast Pacific as outlined by Brusca and Wallerstein (1979). One species (*U. pugettensis*) is limited to the cold Aleutian and Oregonian provinces, 3 species (*U. lepta*, *U. macginitieorum*, *U. onychion*) are known only from the warm temperate California Province, 2 species (*U. burkenroadi*, *U. rugosa*) are known only from the Cortez Province (Gulf of California), 7 species (*U. acanthops*, *U. longipollex*, *U. macrariae*, *U. schmitti*, *U. spinigera*, *U. tenuipollex*, *U. cocosia*) seem to be limited to the tropical Panamic Province, 3 species (*U. dawsoni*, *U. jonesi*, *U. thistlei*) range through Cortez, Mexican (subtropical) and Panamic provinces, 1 species (*U. veleronis*) seems to bridge the latter two provinces, still another (*U. ramphula*) is confined to the Mexican Province, and a final species (*U. galapagensis*) is limited to the Galapagos Province. There is one occurrence of a western Atlantic species (*U. affinis*) in San Francisco Bay. Details of these distributions are set forth in the species accounts that follow.

Material has been examined from the following collections:

- AHF —Allan Hancock Foundation, University of Southern California
- CAS —California Academy of Science
- CICESE—Centro de Investigación Científica y de Educación Superior de Ensenada, B.C.N., Mexico
- ML —Moss Landing Laboratory, California
- NMS —Natur-Museum Senckenberg, Frankfurt
- SDSNH—San Diego Society of Natural History
- SIO —Scripps Institution of Oceanography
- UABC —Universidad Autónoma de Baja California



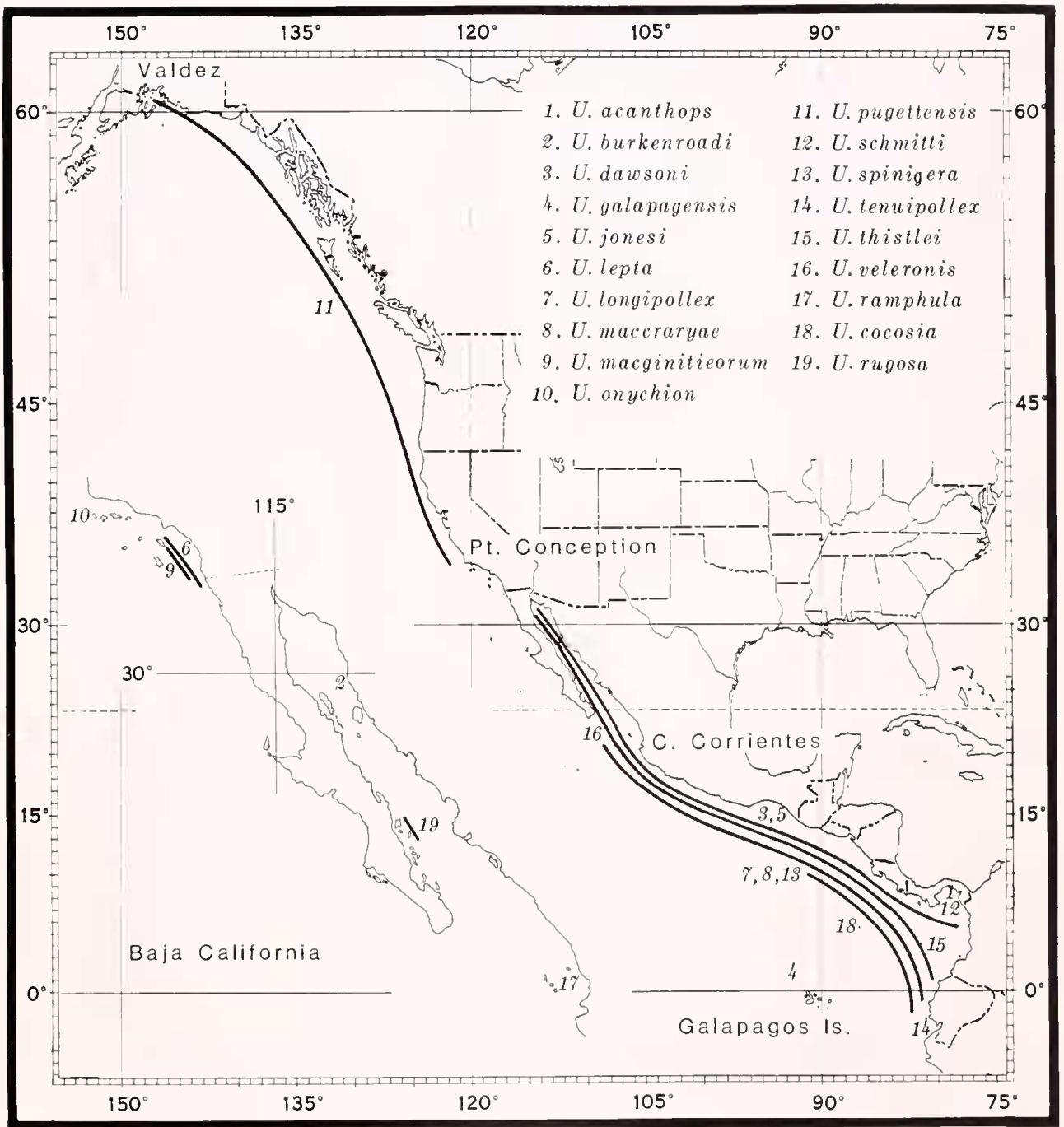


Fig. 1. Distributional ranges from Alaska to Ecuador of 19 eastern Pacific species of *Upogebia*; inset shows detail for southern California and Gulf of California. Numbers for listed species are associated with appropriate range lines or restricted localities.

USGS — U.S. Coast and Geodetic Survey  
 USNM — U.S. National Museum of Natural History

Citations in synonymies are limited to descriptions or references that can be associated specifically. Type-series of newly described species consist

of a holotype and selected specimens designated as paratypes.

#### Acknowledgments

This study was begun in 1976, and had many interruptions before being brought to conclusion.

Help with it has come from many persons and organizations. It was initiated when Anne B. McCrary, University of North Carolina–Wilmington, sent to me for identification specimens that she had collected in Ecuador. An attempt to identify this material lead me to the extensive collections in the USNM, including materials recently collected by C. E. Dawson, M. L. Jones, C. A. Child and others, in Central America. For loan of specimens, access to collections, and related information, I am especially indebted to J. S. Garth and J. Haig (AHF); D. D. Chivers and W. J. Light (CAS); A. Carvacho (CICESE); J. Fausto-Filho, Laboratório de Ciência do Mar, Fortaleza, Ceará, Brazil; K. M. Mawn (ML); M. Türkay (NMS); G. Pretzmann, Naturhistorisches Museum Wien; S. L. H. Fuller and R. H. Gore, Academy of Natural Sciences of Philadelphia; the late G. E. Radwin (SDNHS); W. Newman, S. Luke, and D. Thistle (SIO); E. Campos G., Universidad Autónoma de Baja California (UABC); and

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## SYSTEMATIC ACCOUNTS

### Family Upogebiidae Borradaile 1903

*Diagnosis*.—(Adapted from de Saint Laurent and Le Loeuff 1979.) Carapace compressed laterally, deeper than broad, poorly calcified on posterolateral parts; cervical groove well-marked, crossing near midlength of dorsal line and running obliquely to anterior margin behind base of antennae; thalassinidean line (linea thalassinica) always present in anterior region, sometimes absent or discontinuous in posterior region; gastric region continuous with extensive, flattened rostrum projecting over base of eyestalks, and ornamented on about anterior  $\frac{2}{3}$  with usually spiniform tubercles and thick pile; anterolateral margin either spineless, armed with single postocular spine, or series of spinules.

Cristiform projection on lateral plate of epistome visible in lateral view below base of antenna.

Abdomen elongate, depressed, pleura little developed, second segment longest.

First maxilla with coxal endite triangular, exite broad. First maxilliped with epipod reduced or absent; exopod with flagellum; endopod with 2 articles. Second maxilliped bearing short epipod usually pressed against coxa and fringed with setae; exopod with flagellum. Third maxilliped with or without rudiment of epipod; always with exopod; mesial border of endopod with thick fringe of setae; ischium with crista dentata absent or reduced to row of fine spinules nearly invisible at base of setae, 1

hooked proximal spine on inner surface, occasionally a secondary smaller spine.

Chelipeds equal, symmetrical, and sub- to fully chelate, rarely simple; fixed finger nearly always more slender than dactyl; merus with 2 fringes of long plumose setae ventrally. Second legs with merus as conspicuously setose as that on cheliped; propodus slightly broadened; dactyl short, both densely setose on margin; legs 3 and 4 not so conspicuously setose, dactyls more or less spatulate and bearing comb of stiff setae ventrally; leg 5 with extremity subchelate.

Pleopod 1 absent in male, biarticulate and simple in female; pleopods 2–5 foliaceous, endopod about  $\frac{1}{2}$  as long as exopod, without appendix interna; pleopod 2 without appendix masculina in male. Uropods with no division on exopod.

### Genus *Upogebia* [Leach 1814]

#### Figure 2

*Upogebia* [Leach 1814]:400.—Hemming 1958:143, name no. 1034.—Sakai 1982:8 (complete synonymy).

*Diagnosis*.—Anterior region of carapace with median dorsal furrow (often indistinct and obscured by setae) posterior to rostral tip; lateral ridge separated from ornamented part of anterior carapace by longitudinal groove; anterolateral margin with or without spines; first leg chelate, subchelate or simple (adapted from Sakai 1982).

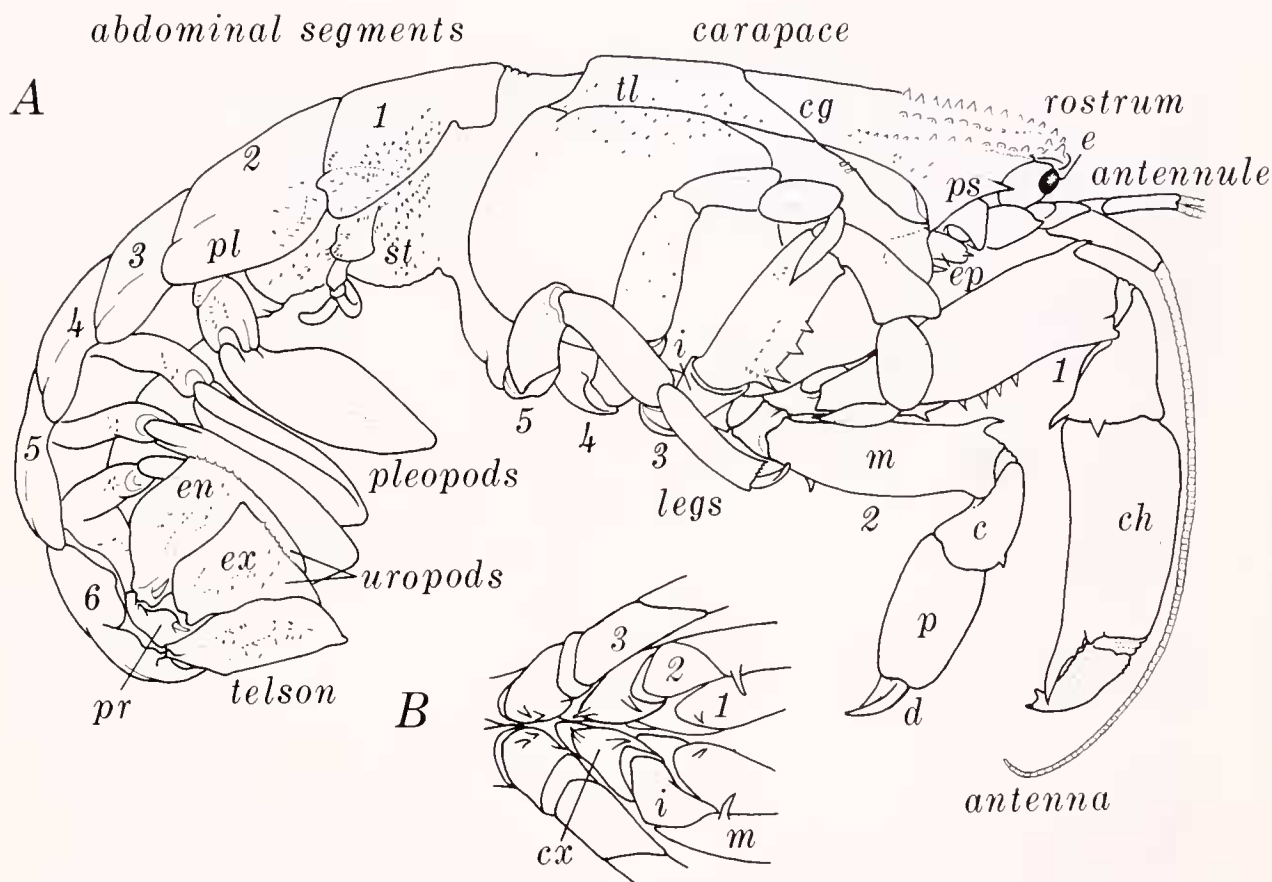


Fig. 2. Schematic drawing of *Upogebia*. A, Animal in lateral view; B, Coxa and associated articles of legs 1-3 in ventral view; c, Carpus; cg, Cervical groove; ch, Cheliped; cx, Coxa (sometimes spined); d, Dactyl; e, Eye; en, Endopodite; ex, Exopodite; i, Ischium; m, Merus (sometimes spined proximally); p, Propodus; pl, Pleuron (sometimes bearing spinules); pr, Protropodite; ps, Postorbital spine; st, Sternite (sometimes bearing spinules); tl, Thalassinidean line.

KEY TO KNOWN EASTERN PACIFIC  
SPECIES OF *UPOGEBIA*

1. Telson with distal margin conspicuously wider than proximal margin ..... 2  
Telson essentially rectangular or somewhat narrowed distally ..... 3
2. Telson with proximal raised area on either side near base of submesial longitudinal rib unarmed. Cocos Is. .... *U. cocosia*, n. sp. p. 55  
Telson with proximal raised area on either side near base of submesial longitudinal rib bearing 1 or more small spinules. Gulf of California ..... *U. rugosa* (Lockington) p. 58
3. Abdomen with lateral margin of segment 6 bearing acute, hooked, anterolateral process; chelae with fingers equal, prehensile edges finely and evenly toothed.

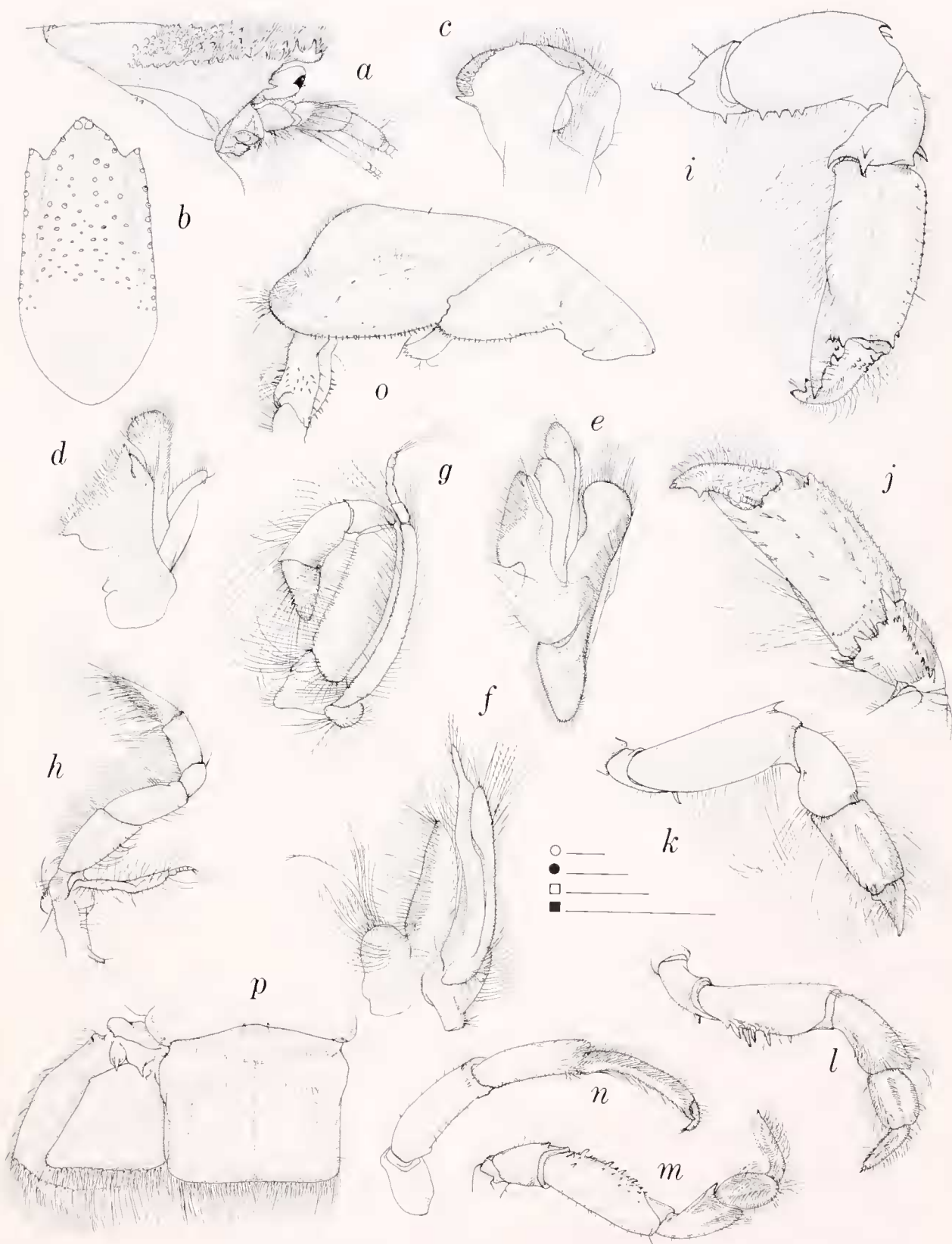
Islas Tres Marías ..... *U. ramphula*, n. sp. p. 52

- Abdomen with lateral margin of segment 6 sinuous or somewhat lobed but lacking anterolateral process; chelae almost always with fingers unequal, prehensile edges not evenly toothed ..... 4
4. Merus of leg 2 lacking proximal mesioventral spine ..... 5  
Merus of leg 2 bearing proximal mesioventral spine ..... 12
5. Postocular spine absent or at most obsolescent (tiny) ..... 6  
Postocular spine present and well developed ..... 8
6. Merus of chelipeds bearing well developed distodorsal spine; merus of leg 3 bearing cluster of proximoventral spines. Ecuador ..... *U. tenuipollex*, n. sp. p. 45

- Merus of chelipeds lacking distodorsal spine or with spine tiny; merus of leg 3 bearing few obsolescent proximoventral spines ..... 7
7. Chelipeds slender, carpus with only 1 strong spine dorsally; fixed finger tapering, slender, and nearly as long as dactyl. Gulf of California ..... *U. burkenroadi*, n. sp. p. 12
- Chelipeds robust, carpus with more than 1 strong spine dorsally; fixed finger stout at base, tapered beyond stout middle tooth to short rather thick point, shorter than dactyl. Southern California ..... *U. macginitieorum*, n. sp. p. 30
8. Leg 3 with spineless merus ..... 9
- Leg 3 with merus ventrally or proximolaterally spined (sometimes inconspicuously) ..... 10
9. Short fixed finger of chelae with rather slender, laterally compressed tip. Alaska to Morro Bay, California ..... *U. pugettensis* (Dana) p. 35
- Short fixed finger of chelae with broad tip flattened on prehensile edge and corneous. San Miguel Island, California ..... *U. onychion*, n. sp. p. 33
10. Rostrum long and slender, exceeding edge of cornea by distal part bearing terminal spines and 3 marginal spines; antennular peduncle with conspicuous slender ventral spine on basal article distally and also on short second article. Baja California Norte ..... *U. lepta*, n. sp. p. 22
- Rostrum short, exceeding cornea by distal part bearing terminal spines and at most 1 marginal spine; antennular peduncle not conspicuously spined ventrally ..... 11
11. Chelipeds with lower margin of ischium smooth, lacking any evidence of spines; dactyl of cheliped with elongate, corneous distal patch, subdistal prehensile tooth reduced or absent. Mexico, Ecuador ..... *U. veleronis*, n. sp. p. 50
- Chelipeds with small ventral spine on ischium; dactyl of chela with short corneous tip preceded by noticeable prehensile tooth. El Salvador to Ecuador ..... *U. macraryae*, n. sp. p. 25
12. Eyestalks with cornea normally rounded distally ..... 13
- Eyestalks obliquely truncate distally and bearing short subterminal spine mesial to reduced, triangular cornea. Panama ..... *U. acanthops*, n. sp. p. 10
13. Abdominal segments 1 and/or 2 spined ventrally on sternites or edge of pleura ..... 14
- Abdominal segments 1 and/or 2 lacking ventral spines ..... 15
14. Merus of leg 4 bearing ventral spines; abdominal segments 1–2 with sternites lacking spines but margin of pleura and bases of pleopods sometimes bearing deciduous spinules; surface of uropods and telson without spinules. El Salvador to Ecuador ..... *U. spinigera* (Smith) p. 41
- Merus of leg 4 spineless; abdominal segments 1–2 almost always bearing spines or spinules (often many) on sternites, margin of pleura, and bases of pleopods; dorsal surface of uropods and telson often strewn with numerous spinules. Central America ..... *U. longipollex* (Streets) p. 24
15. Chelae with spines proximal to fixed finger on ventral keel of palm ..... 16
- Chelae with no spines directly on ventral keel of palm (but mesial surface of palm may bear spines) ..... 17
16. Projection on either side of rostrum set apart by shallow incision; chela with noticeable tooth at midlength of dactyl on cutting edge. Atlantic; Massachusetts to

Fig. 3. *Upogebia acanthops* new species. *a*, Cephalic region, lateral; *b*, Anterior carapace, dorsal; *c*, Mandible; *d*, *e*, Maxilla 1, 2; *f*, *g*, *h*, Maxilliped 1, 2, 3; Cheliped, *i*, lateral, *j*, mesial; *k*, *l*, *m*, *n*, Legs 2–5; *o*, Abdominal segments 1–2, basal articles of pleopods, lateral; *p*, Telson and left uropods. USNM 213194, ♀ Holotype. Scales = 1 mm; ○ = *a*, *b*, *h*, *i*, *j*, *k*, *l*, *m*, *n*, *o*, *p*; ● = *e*; □ = *f*, *g*; ■ = *c*, *d*.







- Brazil. Pacific; one occurrence in San Francisco Bay ..... *U. affinis* (Say) p. 12
- Projection on either side of rostrum set apart by deep incision; chela with large tooth proximal to midlength of dactyl on cutting edge. Gulf of California, Central America ..... *U. jonesi*, n. sp. p. 19
17. Merus of leg 4 bearing ventral spines ..... 18  
Merus of leg 4 spineless (sometimes obsolescent on one side) ..... 19
18. Shoulder flanking cervical groove bearing about 3 granules; fixed finger of chela greater than  $\frac{1}{2}$  length of dactyl. Central America to Ecuador ..... *U. spinigera* (Smith) p. 41
- Shoulder flanking cervical groove bearing well developed spines; fixed finger of chela less than  $\frac{1}{2}$  length of dactyl. Panama ..... *U. schmitti*, n. sp. p. 40
19. Chelipeds with coxa unspined ..... 20  
Chelipeds with coxa drawn into ventral spine. Gulf of California and Central America ..... *U. dawsoni*, n. sp. p. 14
20. Carpus of chelipeds unspined at anterior ventrolateral corner. Galapagos Islands ..... *U. galapagensis*, n. sp. p. 17
- Carpus of chelipeds with spine (often small) at anterior ventrolateral corner. Gulf of California to Ecuador ..... *U. thistlei*, n. sp. p. 47
- of legs 2–4 elongate, that of leg 2 with small ventral spine at proximal  $\frac{1}{3}$  length; shoulder lateral to cervical groove smooth. Caribbean ..... *U. annae* Thistle
- Merus of chelipeds with distodorsal spine at about level of postocular spine; legs 2–4 of normal length, that of leg 2 spineless ventrally; shoulder lateral to cervical groove bearing about 5 obsolescent spines or tubercles. Brazil — *U. brasiliensis* Holthuis
4. Abdominal segments 1 and/or 2 lacking ventral spines ..... 5  
Abdominal segments 1 and/or 2 spined ventrally on sternites or edge of pleura. Panama to Brazil ..... *U. omissa* Gomes Correa
5. Postocular spines 0–2 ..... 6  
Postocular spines 4–5. Caribbean ..... *U. jamaicensis* Thistle
6. Chelae with spines proximal to fixed finger on ventral keel of palm. Massachusetts to Brazil ..... *U. affinis* (Say)
- Chelae with no spines proximal to fixed finger on ventral keel of palm. Fernando do Noronha — *U. noronhensis* Fausto-Filho

### *Upogebia acanthops* new species

#### Figure 3

#### Material examined.—Panama.

USNM—213194 (Holotype) ♀, Fort Kobbe Beach, 8°53'45"N, 79°34'35"W, <1 m, 0–90 m offshore, 30‰ S, C. E. Dawson, 29 June 1979, Nox-fish.

*Diagnosis*.—Postocular spine present. Eyestalk obliquely truncate distally, reaching level posterior to base of subterminal rostral spines; bearing short, subterminal spine mesial to reduced, triangular cornea. Abdominal segments 1 and 2 with corneous spinules on margin of pleura. Telson essentially rectangular. Cheliped with 1 spine on ventral margin of ischium; merus with 2 superior subdistal spines. Merus of leg 2 with strong proximal mesioventral spine, that of leg 4 bearing ventral and ventrolateral spines plus few spinules.

*Description*.—Rostrum short, broadly triangular and slightly deflexed; pair of moderate subapical spines followed on each side by 2 spines of almost equal size, these in turn merging with field of spines and tubercles diminishing over approximately anterior  $\frac{2}{3}$  of anterior dorsal part of carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge

### KEY TO KNOWN WESTERN ATLANTIC

#### SPECIES OF *UPOGEBIA*

(ADAPTED FROM THISTLE 1973)

1. Telson essentially rectangular or somewhat narrowed distally ..... 2  
Telson with distal margin conspicuously wider than proximal margin. Gulf of Mexico and Caribbean ..... *U. operculata* Schmitt
2. Merus of leg 2 lacking proximal mesioventral spine ..... 3  
Merus of leg 2 bearing proximal mesioventral spine ..... 4
3. Merus of chelipeds with distodorsal spine beyond level of postocular spine; merus

bearing similar crest of about 12 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly; all spinose area interspersed with dense tufts of setae. Cervical groove deep and continuous, 2 small spines on shoulder lateral to it below thalassinidean line, latter continuing to posterior margin. Postocular spine present.

Abdomen broadly and smoothly arched dorsally; dense fine setae in band on posterior margin of segments 3 and 4 and in dense tracts on pleura of segments 3–5, scattered setae elsewhere; pleura of segment 1 narrowly rounded posterolaterally, those of segments 2–5 broadly rounded, margins on segments 1 and 2 bearing corneous spinules; segment 6 rectangular, wider than long, lateral margin sinuous, narrow oblique marginal incision anterior to posterolateral lobe near insertion of uropods.

Telson rectangular, sides slightly converging distally, distal margin somewhat convex and densely fringed with setae, transverse ridge at proximal  $\frac{1}{3}$  fairly prominent.

Eyestalk reaching level posterior to base of subterminal rostral spines; longer than deep, upper and lower margins parallel, distal margin oblique and bearing short, subterminal spine mesial to narrowly triangular, anterolaterally directed cornea.

Antennular peduncle reaching about to end of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus slightly longer than upper thicker one.

Antennal peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing almost obsolescent subdistal ventral spine; scale moderate, oval, with distal seta and another at anterodorsal angle.

Mouthparts as figured; maxilliped 3 with epipod.

Epistomial projection rather broad in lateral view, bearing 2 spines at anterodorsal angle.

Right cheliped only present. Ventral margin of ischium bearing single moderate spine. Merus with row of 4 moderate spines on proximal  $\frac{1}{2}$  of ventral margin, 2 superior subdistal spines reaching level of ocular spine. Carpus trigonal, shallow longitudinal groove laterally and acute spine closely preceded by smaller acute spine at ventrolateral corner; mesiodorsal crest of 10 almost uniform small spines behind prominent spine on anterior margin, all directed forward; somewhat smaller spine below latter on middle of distomesial margin and between these a still smaller intermediate spine; distoventral spine strong. Palm oval in cross section, length including fixed finger about 2.1 times maximal height; long fine setae, rather ragged in 3 dorsal rows and longest

in ventral tract; dorsal crest of low, forwardly directed spines flanked laterally by spineless crest and more remotely on mesial surface by crest of obsolescent teeth ending in tooth-tipped inner condyle of dactyl, small tooth below lateral condyle; mesio-proximal surface bearing granular vertical ridge; fixed finger  $\frac{2}{3}$ – $\frac{3}{4}$  length of dactyl, slightly curved and tapered to slender tip, bearing 5 teeth on prehensile edge; dactyl slightly curved and stouter than fixed finger, corneous slender tip preceded by strong tooth on prehensile edge and then row of about 5 calcareous teeth ending in strong tooth near toothless proximal space; 2 rows of tubercles mesially and few tubercles proximally on dorsal and lateral surface.

Leg 2 reaching about to end palm of cheliped; carpus with tiny subdistal ventral spine; elongate merus with hooked superior, subdistal spine, mesioventral spine strong. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of spines ventrolaterally and row of spinules distally on mesiodorsal crest; 1 ventral spine on ischium; coxa with oviducal opening guarded by spine laterally. Leg 4 with ventral and ventrolateral spines, few spinules on merus, a ventral distolateral spine on ischium. Subchelate leg 5 reaching base of cheliped, merus spineless.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Pleopods with basal articles spinulose, first pleopods vestigial, lacking distal articles.

Uropod with spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute scattered distal spines and dense fringe of setae; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing slender spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Length anterior carapace 9.0, length carapace 13.0, length right chela including fixed finger 7.4, height right chela 3.5.

*Known range.*—Confined to type-locality.

*Remarks.*—This species resembles *U. spinigera* of the eastern Pacific in that it possesses a spiny merus on leg 4, small spines flanking the cervical groove, and 2 strong spines at the base of the uropods. It also resembles certain other specimens of that species as well as *U. longipollex* in that it possesses corneous

spinules on the pleura of abdominal segments 1 and 2 and on the bases of the pleopods. However, possession of spined eyes, double dorsal spines on the merus of leg 1, and the deep posterolateral incision on abdominal segment 6 set it apart as a distinct member of the genus.

*Name.*—The specific name is a noun in apposition derived from the Greek “*acantha*,” thorn or prickle, and “*ops*,” the eye, in reference to the small distal spine near the cornea of each eye.

*Upogebia affinis* (Say)

*Gebia affinis* Say 1818:241.

*Upogebia affinis.*—Hay and Shore 1918:408, pl. 29, fig. 9.—Schmitt 1935:196.—Williams 1965:103, fig. 60.—1984:191, fig. 133.—Thistle 1973:23 (key).

*Material examined.*—USA: California.

USNM—213285, 2 ♂, 2 ♀, middle section of San Francisco Bay, R Tang. Red Rk., S 48D E Brothers Lt. N 13D E, Lft. Tang. Marine I., N 41D W (triangulation bearings off Pt. San Quentin), 12.5 fm, CS5532, *Albatross* sta. 5824A, 18 December 1912, sledge trawl, gooey mud.

*Remarks.*—This small collection of *Upogebia* labelled as one of the *Albatross* collections from San Francisco Bay seems identical with *U. affinis* of the western Atlantic. The specimens may represent an introduction of the kind discussed by Carlton (1979), that is 1) of fouling or ballast-dwelling organisms on ships, or 2) nestling invertebrates on and among oysters imported from the western Atlantic. Carlton did not list this species from San Francisco Bay, and to my knowledge no other specimens of this species have been taken there.

Adequate descriptions of *U. affinis* may be found in references cited in the abbreviated synonymy. The known natural range of the species is from Cape Cod, Mass., to the state of São Paulo, Brazil.

*Upogebia burkenroadi* new species

Figure 4

*Material examined.*—Mexico: Sonora.

SDNHS—3985 (Holotype) ♂, 3986 (Paratype) ♀, La Libertad [29°55'N, 112°43'W], collector and date not recorded.

*Diagnosis.*—Postocular spine minute. First and second abdominal segments lacking ventral spines. Telson essentially rectangular. Cheliped with merus bearing tiny, obsolescent subdistal spine on curved

dorsal margin. Merus of leg 2 with tiny subdistal dorsal spine but lacking mesioventral proximal spine, 2 obsolescent spines ventrolaterally.

*Description.*—Rostrum triangular, slightly downturned; tip slightly exceeding eyestalks in female, but extending beyond eyestalks by ½ their length in male; dorsal pair of strong subapical spines followed on each side by 2 spines somewhat smaller in length; dorsal ⅔ of carapace anterior to cervical groove bearing hairlike tufts, its surface spiny anteriorly to tuberculate and angling toward sides posteriorly; gastric ⅓ posterior to this smooth; ornamented anterior part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 12 to 16 spines decreasing from strong on lateral rostral process to obsolescent posteriorly. Cervical groove deep and continuous, shoulder lateral to it smooth; thalassinidean line continuing to posterior margin of carapace. Postocular spine minute.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, pleural margin and sterna of segments 1–2 unarmed; dense fine plumose setae in tracts on pleura of segments 2–6; segment 6 rectangular, wider than long, with lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long but broadest proximally, angle on anterolateral margin interlocking with groove on central rib of uropodal endopod; distal margin slightly biconvex and densely fringed with setae; transverse proximal ridge fairly prominent and continuous with low lateral ridges at each side; median groove obsolescent.

Eyestalks stout, cornea narrower than diameter of stalk and directed anterolaterally.

Antennular peduncle reaching to about proximal ⅓ of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus somewhat longer than thicker upper one.

Antennal peduncle with about ½ its length extending beyond tip of rostrum; article 2 bearing obsolescent subdistal ventral spine; scale moderate, oval.

Mouthparts as figured for *U. pugettensis*; maxilliped 3 bearing epipod.

Epistomial projection rather broad in lateral view, unspined.

Chelipeds essentially equal. Merus with row of 1–3 scattered, obsolescent, spiniform tubercles on ven-



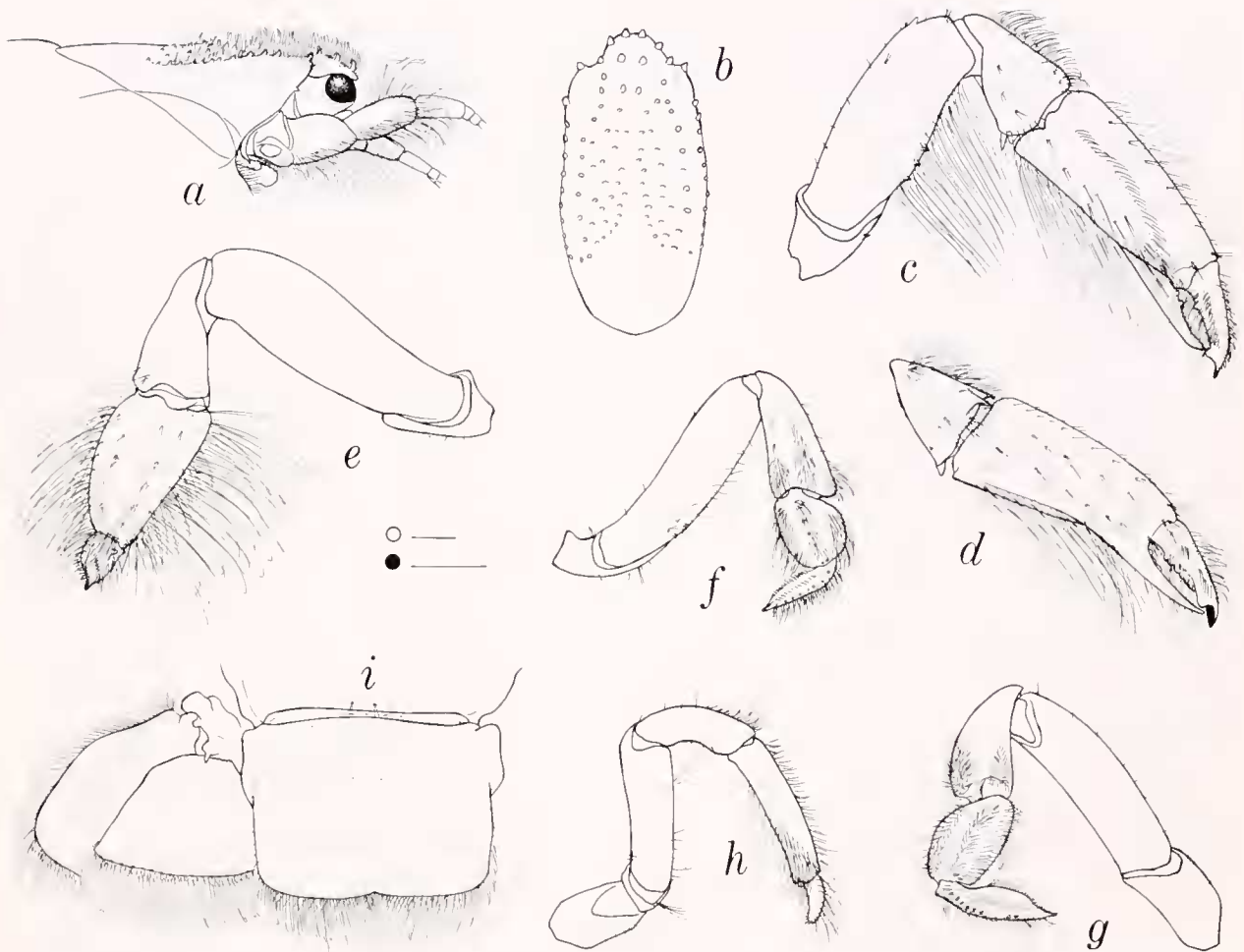


Fig. 4. *Upogebia burkenroadi* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2–5; i, Telson and left uropods. SDNHS 3985, ♂ Holotype; mouthparts and g from 3986, ♀ Paratype. Scales = 1 mm; ○ = a, b, c, d, e, f, h, i; ● = g.

tral margin; minute subdistal dorsal spine reaching level of tiny postocular spine. Carpus trigonal, a shallow longitudinal groove laterally; no spine at anterior ventrolateral corner; mesiodorsal crest of obsolescent granules behind prominent spine on anterior margin; comb of 3 spines remotely lateral to this on anterior margin and 1–3 obsolescent tubercles below it on distomesial margin; distoventral spine slender but strong. Palm oval in cross section, length including fixed finger about 3 times maximum height; 3 dorsal rows and 1 mesiodorsal row of scattered sparse setae. Fingers relatively straight; fixed finger about  $\frac{4}{5}$  length of dactyl, slightly curved and tapering to slender tip reaching beyond level of strong subdistal dactylar tooth, bearing about 3 teeth on proximal prehensile edge. Dactyl stouter than fixed finger, its curved upper surface smooth; slightly bent tip corneous on prehensile edge and preceded

by strong tooth, that in turn by a more or less straight raised edge capped by row of about 8 teeth, smaller and close-set distally but with proximalmost larger tooth remote, toothless proximally.

Leg 2 reaching to distal  $\frac{1}{4}$  palm of cheliped; carpus toothless; merus with tiny subdistal dorsal spine but lacking mesioventral, proximal spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of obsolescent spines ventrolaterally. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with acute small spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, distal margin of exopod on adult female with few ob-



solescent granules but distal margins otherwise smooth and bearing dense fringe of setae; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial one strongest, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Male holotype, length anterior carapace 6.4, length carapace 9.4, length chela including fixed finger 6.1, height chela 2.1. Paratype female, same, 7.7, 11.5, 7.3, 2.4.

*Known range.*—Confined to type-locality.

*Remarks.*—*Upogebia burkenroadi*, represented by only two known specimens, resembles *U. tenuipollex* in the disposition of spines on legs 1 and 3, and in possession of a postocular spine, though having all of these much less well developed. It also resembles *U. macginitieorum* which usually lacks the postocular spine and has much more robust chelae with shorter fixed fingers, but *U. burkenroadi* lacks bands of setae on the posterior margin of the terga of segments 3–4, whereas they are present in *U. macginitieorum*.

*Name.*—The species is named for Martin D. Burkenroad, one of the chief architects of currently accepted decapod crustacean classification, and a student of *Upogebia* in California and Mexico.

*Upogebia dawsoni* new species

Figure 5

*Material examined.*—Mexico: Baja California Norte.

AHF—2566-01, 1 ♂, New Kino, P. Vreeland, 16 November 1969; 2351-02 (Paratypes 4012) 3 ♂, 7 ♀, S of Pond Is., Angel de la Guarda Is., *Velero III* sta. 1079-40, 4 February 1940.

SDNHS—3987 (Paratypes) 7 ♂, 4 ♀, 2 juv., San Felipe, sand base of berm at Pete's Place, 31 October [1971]; 4006, 2 ♂, 2 ♀, San Felipe, Pete's camp among boulders at berm, 2 October 1971.

UABC—Uncat. 3 ♂, 1 ♀, Laguna Percebu, San Felipe, mesolittoral, E. Campos G., 11 July 1981.

Baja California Sur.

CAS—1 ♀ ovig., SW end of Espíritu Santo Is., bay just south of No Name Bay, CAS Sea of Cortez Exped., D. D. Chivers, SLF #C-08, 18–19 August 1965.

CICESE—Uncat. 7 ♀, Estuary of Mulegé River, 26°54'N, 111°59'W, Ruben Rios, 23 March 1981.

USNM—213209, 1 ♀, Cove S of Ballena Bay, Espíritu Santo Is., AHF 511-36, 2 February 1936; 213226, 1 ♂, 1 ♀ (poor condition); La Paz, L. Belding, 4635, 1882.

Sonora.

AHF—2480-01, 1 ♂, Estero Morua, tidal creek, P. Buettner, 3 August 1980; 2479-01, 2 ♂, same, 8 May 1981; 2567-01 (Paratypes 673) 2 ♀, Tastiota, coarse sand, P. Pickens, #34, 26 March 1967.

SDNHS—4007, 10 exuvia; Cholla Bay N point, sandy mud outside estero at base of rock point; 4 October 1971.

Jalisco.

USNM—213297 (Holotype) ♀, Laguna de Navidad, Barra de Navidad, ca. 19°11'14"N, 104°41'25"W, 0–4 ft, Chem-fish over sandy mud bottom, C. E. Dawson 1236, 19 August 1967; 213208 (Paratypes) 8 ♂, 22 ♀ (11 ovig.), same.

Costa Rica.

USNM—213210, 4 ♂, 6 ♀ (1 ovig. and some fragmentary) plus 2 unsexable frags., Liberia, Bahia de Potrero Grande, estero del Rio Potrero, 10°51'15"N, 85°48'50"W, 0–3 ft, sand, mud, fringing mangroves, Dawson and Dawson 1475, 23 June 1971, Nox-fish; 213211 (Paratypes) 2 ♂, Isla S. Lucas, M. Valerio, 751, 15 January 1930.

Panama.

USNM—213212, 1 ♀ (incomplete exuvium), Bahia Honda, AHF 5-33, W. L. Schmitt, 10 January 1933; 213213, 1 ♀, NE end of causeway to Naos Is., 08°56'07"N, 79°32'47"W, 0–2 in, bottom of tide-pools over silt, gravel and small rock, C. E. Dawson 1527, ichthyocide, 18 March 1972.

*Diagnosis.*—Postocular spine present. Rostrum with extremity exceeding eyestalks, often bearing small terminal or subterminal ventral spines. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with coxa drawn into ventral spine, ischium bearing 1 ventral spine. Merus of leg 2 with proximal mesioventral spine, that of leg 4 lacking ventral spines.

*Description.*—Rostrum rather narrowly triangular, straight to slightly downturned; tip exceeding pair of rather small, subapical dorsal spines situated more or less side by side and followed on each side

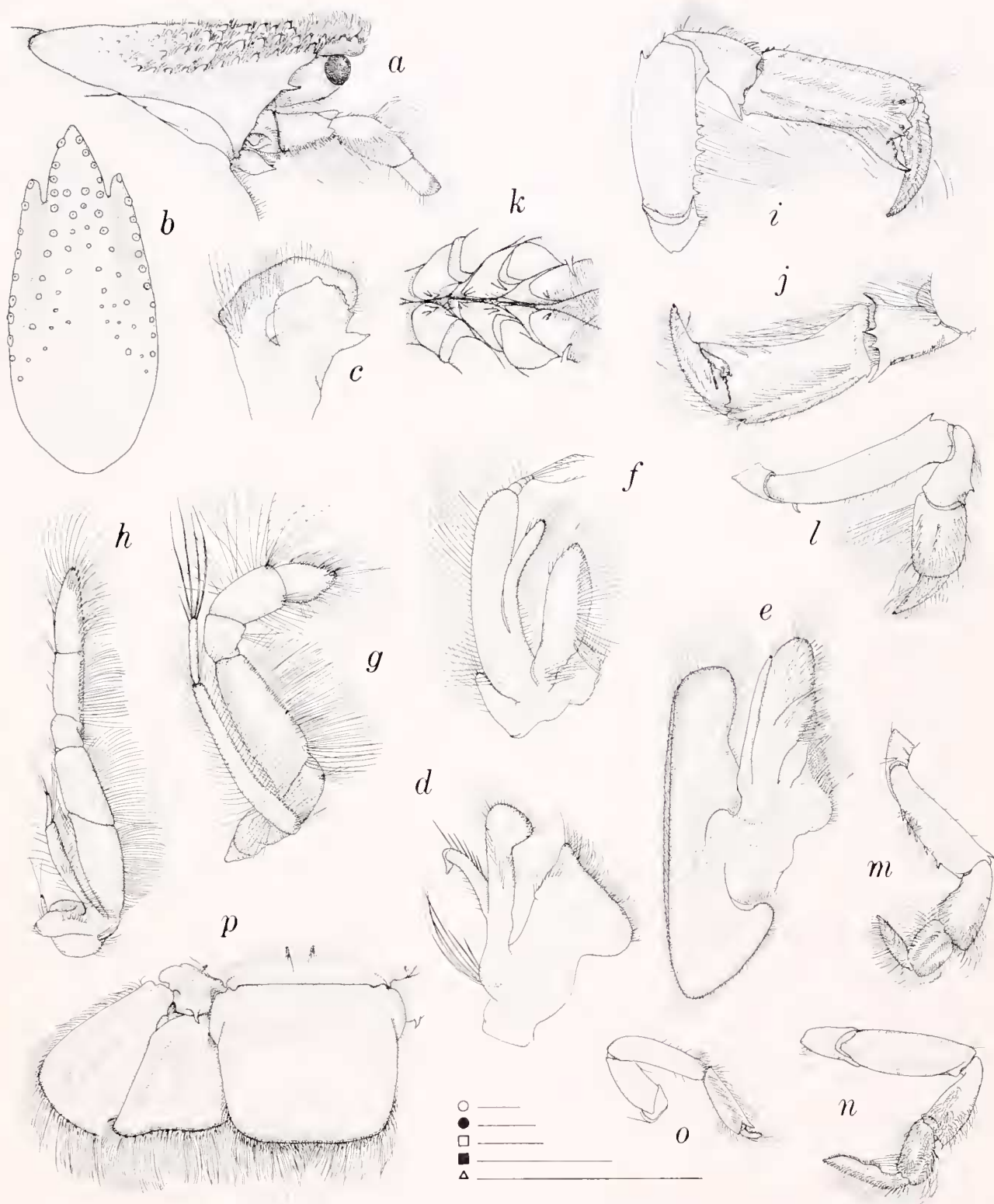


Fig. 5. *Upogebia dawsoni* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, Coxa and associated articles, legs 1-3; l, m, n, o, Legs 2-5; p, Telson and left uropod. CICESE, ♂ uncat.; mouthparts from USNM 213207. Scales = 1 mm; ○ = i, j, l, m, n, o; ● = a, b, k, p; □ = h; ■ = d, e, f, g; △ = c.

by 2–5 spines of about equal size; prominent ventral spines often present; dorsal rostral surface nearly bare in midline but densely setose to each side and almost spineless, merging with setose field of spines, spiniform tubercles and tubercles diminishing over approximately  $\frac{2}{3}$  of anterodorsal carapace and angling toward sides posteriorly; posterior gastric region smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 9–12 elements decreasing from spines on deeply separated lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, rather sharp shoulder lateral to it bearing up to about 6 irregularly spaced spines (often obsolescent) below level crossed by thalassinidean line, latter continuing to posterior margin of carapace. Postocular spine present.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae sometimes laterally on posterior margin of segments 3 and 4 and in tracts on pleura of segments 3–5, tuft on posterolateral corner of 2; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson essentially rectangular, distal margin almost straight and densely fringed with setae; transverse anterior ridge variably moderate, continuous with low lateral ridges at each side, median groove obsolescent.

Eyestalk reaching to about level of subdistal dorsal spines on rostral margin; more or less angled upward, prominent terminal cornea directed anterolaterally.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus clearly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 bearing strong subdistal ventral spine; scale moderate, oval with pointed tip.

Mouthparts as figured for *U. jonesi*; maxilliped 3 bearing epipod.

Epistomial projection in lateral view, tapered to single small spine.

Chelipeds essentially equal, rather slender in female, stouter in male. Coxa drawn into hooked ventral spine. Ventral margin of ischium bearing 1 spine.

Merus with 5 spines on ventral margin; subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, and spine at anterior ventrolateral corner, strong in males and often preceded by crest of forward pointing spines; mesiodorsal crest of forwardly directed uniform spines behind prominent spine on anterior margin, all directed forward; latter flanked by cluster of 2–4 small spines on anterodorsal margin and followed below on distomesial margin by 2 strong spines, ventral one largest; distoventral spine strong. Palm oval in cross section, length including fixed finger slightly over 3 times maximal height, depending on size ( $\bar{x} h/1$ :  $F = 0.36 \pm 0.04$ ,  $M = 0.36 \pm 0.061$  in sample of 23 and 14 respectively); prominent setae in 4 dorsal rows, longer in ventral tract, some setae along low lateral ridge, and tufts distally; 2 dorsal crests fairly prominent, 1–3 erect spines at or near proximal end of lateral one, and another of submarginal row of tubercles at distal end, sometimes with scattered spines in proximal part; lateral condyle of dactyl with spine below it and sometimes a spiny ridge plus obsolescent tubercles proximal to it (in males), mesial condyle with 1–3 spines below followed by 0–5 small teeth on distal margin of palm; mesioproximal surface bearing low granular ridge. Fixed finger much shorter than dactyl, dorsoventrally broad at base but distally rather slender, gently curved tip; 1–3 obsolescent teeth in middle of prehensile margin, occasionally with tiny obsolescent teeth proximally. Dactyl slightly curved, setose, stouter than fixed finger, and tapered to corneous slender tip; obsolescent teeth on prehensile edge with larger tooth occasionally at about midlength; obscure rows of tubercles mesially, variable tubercles proximally on dorsal surface.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus bearing slender subdistal dorsal spine; elongate merus with slender subdistal dorsal spine and strong, somewhat hooked proximal mesioventral spine; coxa often with proximal and distal spine on mesial aspect, especially in males. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with row of 3 ventral spines flanked laterally by 1 or more, coxa with strong spine flanking oviducal opening. Leg 4 usually with spineless merus, but occasionally with 1 proximal spine. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with spine on protopod overhanging base



of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae distally, and occasionally with barely perceptible scattered granules on distal margin; endopod with rather prominent median longitudinal rib and lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest, bearing blunt or obsolescent spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype female, length anterior carapace 7.2, length carapace 10.4, length chela including fixed finger 4.7, height chela 1.6. Paratype male, same, 7.9, 10.9, 8.3, 4.2.

*Known range.*—San Felipe, Baja California Norte, to Canal Zone of Panama.

*Remarks.*—*Upogebia dawsoni*, one of the species with a strong proximal spine on the merus of leg 2, resembles *U. galapagensis* new species and *U. thistlei* new species in the Pacific, and *U. noronhensis* Fausto-Filho in the Atlantic. It differs from the latter in having one rather than two ventral spines on the ischium of the cheliped, and from each of the three in having the coxa of the chelipeds drawn into a ventral spine. There is considerable variation and sexual dimorphism in *U. dawsoni*, enough that males and females might sometimes be mistaken for separate species. The rostrum may or may not have ventral spines, which tend to be more prominent in males. Chelae of the males and females are quite different. Those of males are much broader and heavier as well as ornamented with sometimes strikingly heavy tubercles or spines, especially on a ridge adjacent to the lateral condyle of the dactyl, and the dactyl may bear a field of tubercles on the proximal part of the dorsal surface. Males often have seemingly rudimentary oviducal openings on the coxae of the third legs (false hermaphrodites), but they lack the first pair of pleopods.

*Name.*—The species is named for C. E. Dawson, Gulf Coast Research Laboratory, Ocean Springs, Miss., who collected the type series as well as a wealth of other material reported in this paper.

#### *Upogebia galapagensis* new species

##### Figure 6

*Material examined.*—Ecuador.

CAS—2073 (Paratypes) 3 ♂, 8 ♀, Tower Island (=Isla Genovesa), Galapagos Islands, Galapagos International Scientific Project, A. G. Smith, tide pools

back of Darwin Bay in coral mud impregnated with guano [G-18], 30 January 1964.

NMS—2530 (Paratype) 1 ♀, Academy Bay, Indefatigable Is., Galapagos Islands, S. Eible, 6 August 1957.

USNM—213222 (Paratypes) 3 ♂, 1 ♀, Academy Bay, Indefatigable Is., Galapagos Islands, shore SW of landing, W. L. Schmitt, AHF 49-33, 3 February 1933; 213223 (Holotype) ♀, same, S of Rader's place AHF 49-33, 3 February 1933; 213224 (Paratypes) 3 ♂, 4 ♀ (1 ovig.) same, S of Rader's place, AHF 52-33, 4 February 1933; 213225 2 ♂, same, in front of Rader's AHF 168-34, 20 January 1934.

*Diagnosis.*—Postocular spine present. Rostrum with extremity exceeding that of eyestalks, its tip in lateral view clearly exceeding dorsal spines, unspined ventrally. Abdominal segments 1 and/or 2 lacking ventral spines. Telson essentially rectangular. Cheliped with fixed finger  $\geq 0.60$  length of cutting edge of dactyl; palm of chela posterior to base of fixed finger spineless mesially; ischium with 1 spine on ventral margin. Legs slender; leg 2 with merus  $\geq 4$  times width and bearing mesioventral spine; merus of leg 4 lacking ventral spines.

*Description.*—Rostrum rather narrowly triangular and almost straight; pair of moderate subapical spines followed on each margin by 3 spines smaller in size and these in turn merging with field of spinous tubercles diminishing over anterior  $\frac{2}{3}$  of anterior dorsal part of carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 10 spiniform tubercles decreasing from strongest on lateral rostral process to obsolescence posteriorly; all spinose area interspersed by dense tufts of setae. Cervical groove deep and continuous, no spines (rarely obsolescent) on shoulder lateral to it. Postocular spine present.

Abdomen broadly and smoothly arched dorsally, scattered setae on segments 3–6 with denser tracts on pleura of segments 3–5; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded; segment 6 rectangular, slightly wider than long, pleura formed into shallowly bilobed anterior lobe and posterior lobe adapted for articulation of uropods, dorsally marked with obsolescent sinuous groove at side.

Telson rectangular, slightly wider than long, parallel sided; very slightly biconvex distally and densely fringed with setae; anterior transverse ridge fairly sharp.



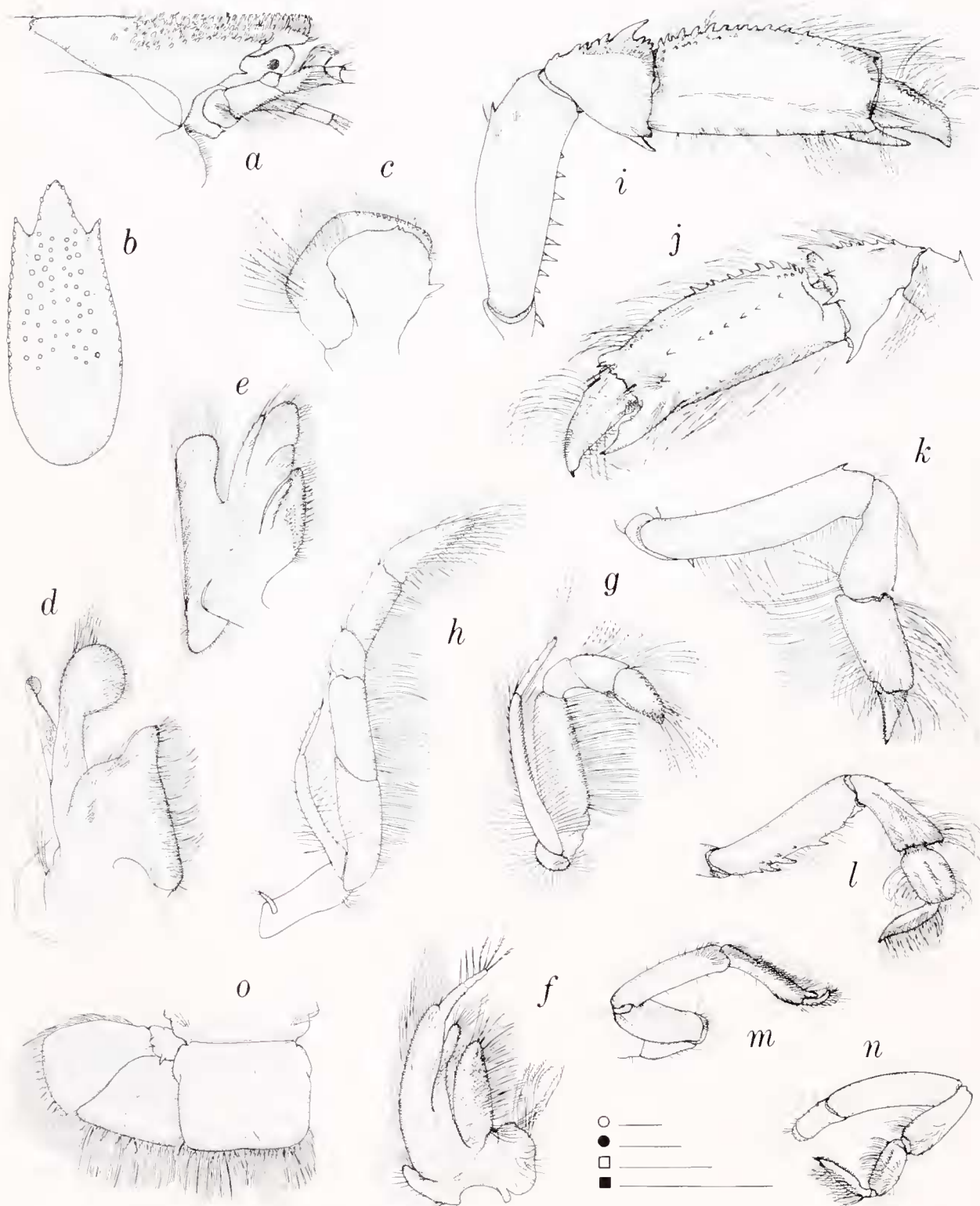


Fig. 6. *Upogebia galapagensis* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, l, m, n, Legs 2-5; o, Telson and right uropods. USNM 213223, ♀ Holotype; mouthparts from CAS 2073. Scales = 1 mm; ○ = a, b, i, j, k, l, m, n, o; ● = h; □ = e, f, g; ■ = c, d.

Eyestalk reaching level of penultimate rostral spine, moderately thickened; cornea rather large though not dilated, directed anteroventrally.

Antennular peduncle reaching proximal  $\frac{1}{4}$  of terminal article in antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus  $\frac{1}{4}$  longer than upper thicker one.

Antennal peduncle with  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 bearing nearly erect subdistal ventral spine; scale small, oval, bearing minute anterior spine.

Mouthparts as figured for *U. jonesi*; maxilliped 3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing 1 or 2 spines, sometimes asymmetrical.

Chelipeds essentially equal. Ventral margin of ischium bearing slender hooked spine. Merus with superior, subdistal spine reaching level of ocular spine, row of 5 or 6 irregularly spaced, moderate spines on ventral margin. Carpus trigonal, a shallow longitudinal groove laterally; with mesiodorsal crest of small spines and a strong spine all directed forward; 3 or 4 much smaller spines laterally on anterior margin, and below anterodorsal spine on mesiodistal margin a smaller intermediate spine followed by a stronger median spine; distoventral spine strong but slender. Palm oval in cross section, length including fixed finger about 4 times maximal height; hand with rows of long silky setae, densest in 3 mesiodorsal rows and longest in ventral tract; proximal dorsal crest of small spines originating near articular condyle of carpus flanked laterally by longer spineless crest; with or without row of (or scattered) small spines on mesial and/or lower surface, lunate crest on proximomesial surface, and irregular row of about 3 spines on distomesial margin, dorsalmost spine near dactylar condyle largest; fixed finger  $\frac{1}{2}$ – $\frac{3}{4}$  length of dactyl, blunt tipped, rather slender distally, broadening proximal half with row of 4–5 low teeth on prehensile edge; dactyl slightly curved and stouter than fixed finger, corneous and rather blunt to moderately slender tip sometimes immediately preceded by worn or obsolescent tooth, with variable crest of low teeth running along nearly proximal  $\frac{2}{3}$  of prehensile edge to end in slightly larger, rounded tooth anterior to shallow, basal notch; teeth opposed to tip of fixed finger usually slightly enlarged.

Leg 2 reaching beyond midlength palm of cheliped; carpus with tiny subdistal dorsal and still smaller ventral marginal spine; elongate merus with

superior, subdistal spine directed almost straight distally, mesioventral proximal spine strong, straight and slightly reflexed. Leg 3 with slender, pointed dactyl extending beyond rostrum; merus with 3 spines along lower margin. Leg 4 spineless, not quite reaching tip of rostrum; all 3 articles bearing tracts of long setae. Leg 5 reaching base of cheliped, merus spineless.

Two arthrobranches arranged in biserial rows of undivided (entire) narrow lamellae on maxilliped 3 and legs 1–4.

Uropod with slender spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute, scattered, distal spines and dense fringe of setae; endopod with strong, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one with spiniform tubercle proximally, intermediate rib longer but weaker; lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype female, length anterior carapace 7.4, length carapace 10.4, length right palm with fixed finger 5.3, height palm 1.8.

*Known range.*—Galapagos Islands.

*Remarks.*—*Upogebia galapagensis* most closely resembles *U. thistlei*, from which it differs in having more slender chelae which lack a small spine at the anterior ventrolateral corner of the carpus and in having generally more slender fingers. Similarities to *U. spinigera* and *U. longipollex* are given in the remarks on *U. thistlei*.

*Name.*—The specific name “galapagensis” refers to the island origin of the material studied.

#### *Upogebia jonesi* new species Figure 7

*Material examined.*—Mexico: Baja California Norte.

AHF—2537-01, 1 ♀, off Consag Rock, 31°06'30"N, 114°28'152"W, 21 fm, *Velero III* sta. 1069-40, 1 February 1940; 2546-01 (Paratype 4013) 1 ♀, off Punta Willard, Bahia San Luis Gonzaga, 30–40 fm, mud, *Velero III* sta. 1061-40, 30 January 1940.

Sonora.

AHF—2543-01, 1 ♀, off Punta Roca, 31°18'35"N, 113°37'55"W, 11 fm, mud, sand, *Velero III* sta. 1074-40, 3 February 1940.

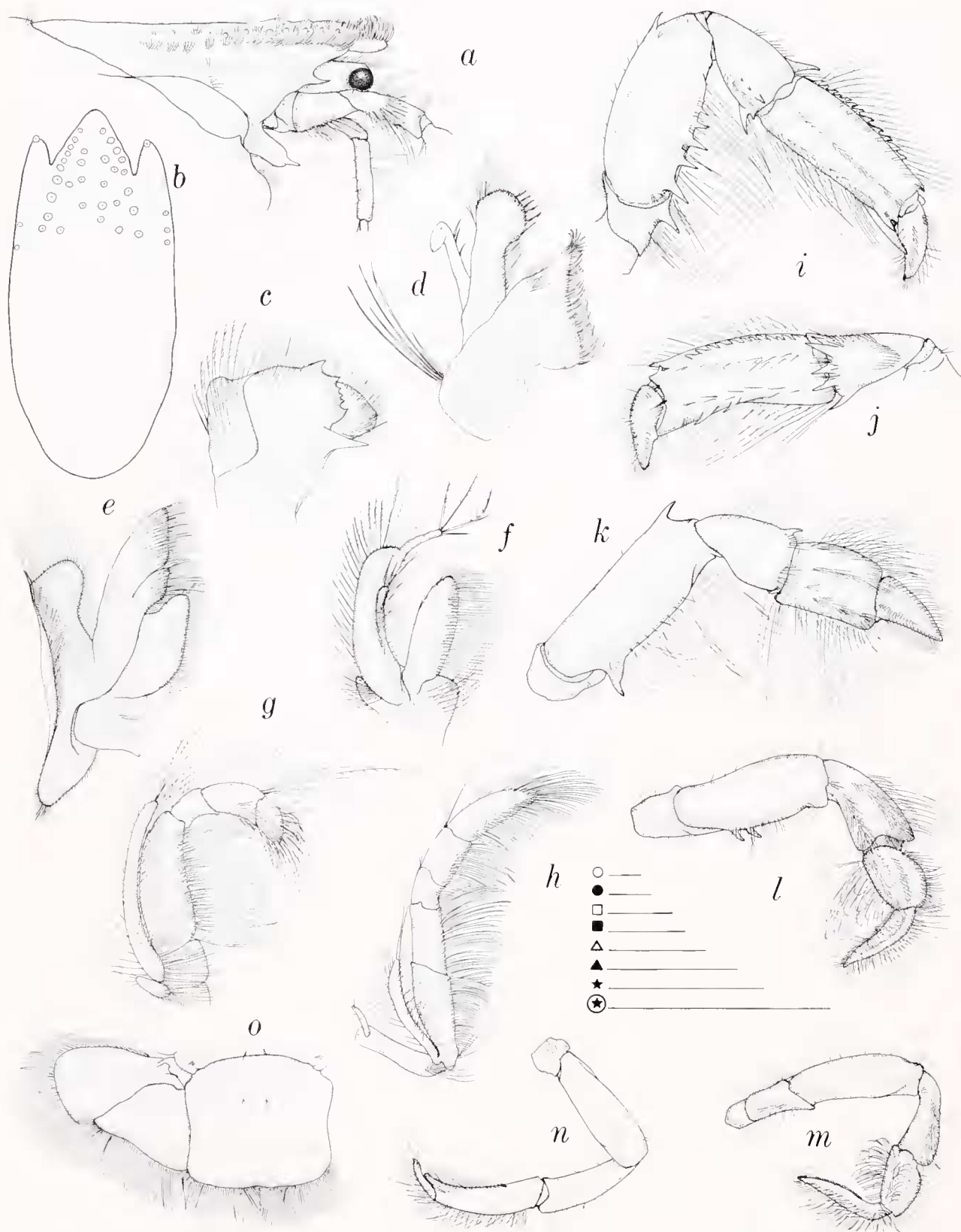


Fig. 7. *Upogebia jonesi* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, l, m, n, Legs 2-5; o, Telson and left uropods. USNM 213195, ♀ Holotype; mouthparts from USNM 21398. Scales = 1 mm; ○ = a, b; ● = o; □ = i, j, k, l, m, n; ■ = h; △ = f; ▲ = e, g; ★ = d; ⊛ = c.



## Costa Rica.

USNM—213198, 2 ♂, 1 ♀ (ovig.), Golfo de Nicoya, University of Delaware and University of Costa Rica (UDUCR), sta. 15-2-1000, 12 July 1980; 213199, 1 ♂, 1 ♀, Golfo de Nicoya UDU CR, sta. 30-3-1000, 1 October 1980; 213200, 1 juv., Golfo de Nicoya, UDU CR, sta. 29-3-1000, 27 January 1981; 213201, 1 ♂, Golfo de Nicoya, UDU CR, sta. 29-4-1000, 4 April 1981.

## Panama.

USNM—213195 (Holotype) ♀ (ovig.), Pilot House Beach, Naos Is., lower end of beach transect, 27°C, 25‰ S. M. L. Jones, sta. 245-1, 8 January 1978; 213196 (Paratype) 1 ♂, same; 213197 (Paratypes) 1 ♂, 1 ♀ (ovig.), S side Perico Is., M. L. Jones, sta. 266-2, 22 July 1978.

*Diagnosis.*—Postocular spine present and acute. First and second abdominal segments lacking ventral spines. Telson essentially rectangular. Cheliped with mesial row of 2–3 spines on palm proximal to base of fixed finger; more than half length of dactyl beyond large tooth on cutting edge. Second leg with prominent mesioventral spine on merus. Projection to either side of rostrum fairly acute at tip.

*Description.*—Rostrum almost equilaterally triangular in dorsal view and densely setose, flanked by somewhat shorter, subacute lateral projection at each side; tip rounded, slightly exceeding eyestalks, nearly horizontal in lateral view, ventral border spineless and curved gently upward to tip; lateral borders bearing about 4 small conical teeth; surface behind rostrum armed with small conical teeth anteriorly but grading to tubercles posteriorly and angling toward sides; central gastric region smooth; ornamented area separated from and flanked on each side by posteriorly divergent ridge bearing crest of about 12 elements decreasing from strongest on lateral rostral process to obsolescence posteriorly. Anterolateral margin bearing prominent, slender postocular spine. Shoulder lateral to cervical groove not prominent; thalassinidean line extending to posterior margin of carapace.

Abdomen with first 2 segments lacking spines or spinules on sterna, pleura and bases of pleopods; segment 6 rectangular, its dorsal surface with obsolescent, obliquely curved groove to either side, lateral margin with angled lobe behind middle. Telson rectangular.

Eyestalk clearly exceeded by rostrum; cornea narrower than eyestalk, directed anterolaterally.

Antennular peduncle with articles unspined. Antennal peduncle with small distoventral spine on

basal article; rather prominent, slender, distoventral spine on article 2; scale unspined.

Mouthparts as figured; maxilliped 3 bearing epipod.

Extension of epistome in lateral view bearing single slender spine.

Chelipeds essentially equal, slender to moderately robust; coxa armed with small spine; ischium with prominent, slender, curved ventral spine; merus with ventral row of 4 or 5 slender spines of irregular length and a strong subdistal dorsal spine. Carpus with strong, slender anteromesial spine preceded by low mesiodorsal crest bearing 2 spines and flanked laterally by 2 small spines; moderate lateral spine on anterior margin, 2 strong spines on anterior margin mesially, and slender anteroventral spine. Palm more or less compressed but convex on lateral surface, about twice as long as deep; bearing mesiodorsal crest of about 12 small acute, anteriorly directed spines; lateral to these a spineless crest; subdistal dorsal spine and lateral distal spine near base of dactyl; row of 2 acute anteriorly directed spines proximal to base of fixed finger. Fixed finger less than ½ length of dactyl, drawn to slender point, low tooth at midlength. Much longer grooved dactyl gently curved to simple, slender, corneous tip; prehensile edge obscurely toothed.

Legs 2–5 with usual setose tracts; merus of leg 2 with very strong proximal spine and well developed subdistal dorsal spine; merus of 3 with 2 or 3 spines on ventral border; 4 with spineless merus.

Two arthrobranchs arranged in biserial rows of undivided (entire) narrow lamellae on maxilliped 3 and legs 1–4.

Uropod exceeding telson, small acute spine on protopod lateral to articulation of endopod; smaller spine proximally on inner rib of exopod.

*Measurements (mm).*—Holotype female, length anterior carapace 5.1, length carapace 7.6, length chela including fixed finger 3.6, height chela 1.4. Paratype male, same, 4.2, 6.1, 3.6, 0.6.

*Variation.*—Chelae of small specimens from Costa Rica are relatively more slender than those of larger specimens from Panama, but in other respects both sets of specimens seem identical.

*Known range.*—Mexico to Panama.

*Remarks.*—*Upogebia jonesi* seems to be a Pacific counterpart to the western Atlantic *U. affinis*, though it is apparently a smaller species and has fewer mesial spines on the palm proximal to the fixed finger of the chelipeds than the latter. This comparison should be qualified because our knowledge of variation in the widespread *U. affinis* needs study.

*Name.*—The species is named for Meredith L.

Jones, Department of Invertebrate Zoology, U.S. National Museum of Natural History, under whose leadership the NMNH Panama Survey of the Canal Zone fauna was conducted during the 1970s, when many specimens of *Upogebia* were collected.

*Upogebia lepta* new species

Figure 8

*Material examined.*—USA: California.

AHF—2536-01 (Paratype 4130) 1 ♂, ½ mi SW Ribbon Rock, Santa Catalina Is., 33°26'05"N, 118°34'50"W, 51–56 fm, *Velero III* sta. 1312-41, 4 May 1941; 2540-01 (Paratypes 4131) 10 ♂, 9 ♀ (1 ovig. frag.), plus assorted frags. of several specimens, 1 mi SW Ben Weston Pt., Santa Catalina Is., 33°20'55"N, 118°30'25"W, 45–49 fm, *Velero III* sta. 1316-41, 17 May 1941.

Mexico: Baja California Norte.

USNM—213270 (Holotype) ♂, Los Coronados Is. [32°25'N, 117°15'W], 73–91 m (40–50 fm), S. A. Glassell, 4/11/28 [11 April 1928]; 2137 (Paratype) ♂, same.

*Diagnosis.*—Postocular spine present. Rostrum with extremity distinctly exceeding that of eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with fixed finger about half as long as dactyl; palm with lunate row of spines on mesial surface; ischium with small spine on ventral margin. Leg 2 without proximal mesioventral spine on merus; merus of leg 4 lacking ventral spines.

*Description.*—Rostrum narrowly triangular, straight; tip exceeding pair of small, subapical dorsal spines, latter followed on each side by 4 spines of about equal size; central dorsal rostral surface densely pilose but almost spineless, merging with less pilose field of spiniform tubercles and tubercles diminishing over approximately ¾ of anterodorsal carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 9 elements decreasing from spines on lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, rather sharp shoulder lateral to it; thalassinidean line continuing to posterior margin of carapace. Postocular margin bearing spine.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; fine setae in posterolateral tracts on pleura

of segments 3–4; segment 6 rectangular, slightly wider than long, lateral margin with slight shoulder at midlength and margins convergent thereafter.

Telson rectangular, sides slightly lobed proximally, posterior margin very shallowly biarcuate and densely fringed with setae; transverse anterior ridge obsolescent, continuous with low lateral ridges at each side, median groove obsolescent.

Eyestalk far shorter than long rostrum, reaching level of third dorsal spines on rostral margin; somewhat constricted at midlength between dilated base and good sized subglobular, terminal cornea.

Antennular peduncle reaching to between base of and about midlength of terminal article of antennal peduncle, its proximal article about as long as second plus terminal article together and bearing prominent distoventral spine, short second article with similar sized ventral spine; flagella unequal, lower thinner ramus decidedly longer than thicker upper one.

Antennal peduncle with about ¾ its length extending beyond tip of rostrum; article 2 spineless distally; scale moderate, more or less rhomboid in outline.

Mouthparts as figured for *U. pugettensis*; maxilliped 3 bearing epipod.

Epistomial projection quite broad in lateral view, bearing single, slender anterodorsal spine.

Chelipeds essentially equal, rather slender. Ventral margin of ischium bearing 1 short spine. Merus with variable number of spines on ventral margin (4–9); short subdistal dorsal spine (if present) reaching level of postocular spine. Carpus trigonal, an obsolescent longitudinal groove laterally, no spine at anterior ventrolateral corner; mesiodorsal crest with forwardly directed uniform small or obsolescent spines behind prominent spine on anterior margin, or with only 1 or 2 prominent spines in anterior part of row; anterior spine flanked by remote cluster of 3 sharp spines on anterodorsal margin and followed below on distomesial margin by 1 moderate spine; distoventral spine moderate. Palm oval in cross section, length including fixed finger about 2.5–2.8 times maximal height; inconspicuous setae in dorsal rows, longer in ventral tract, some setae along low lateral ridge, and tufts distally; lateral dorsal crest of mostly low spines running ¾ length of palm, becoming obsolescent distally but ending near prominent spine near base of dactyl; mesiodorsal crest bearing 1 or 2 spines proximally, becoming obsolescent through about ¾ its length, but reappearing distally as a thin low crest, entire except for outlying spine at its proximal end, then



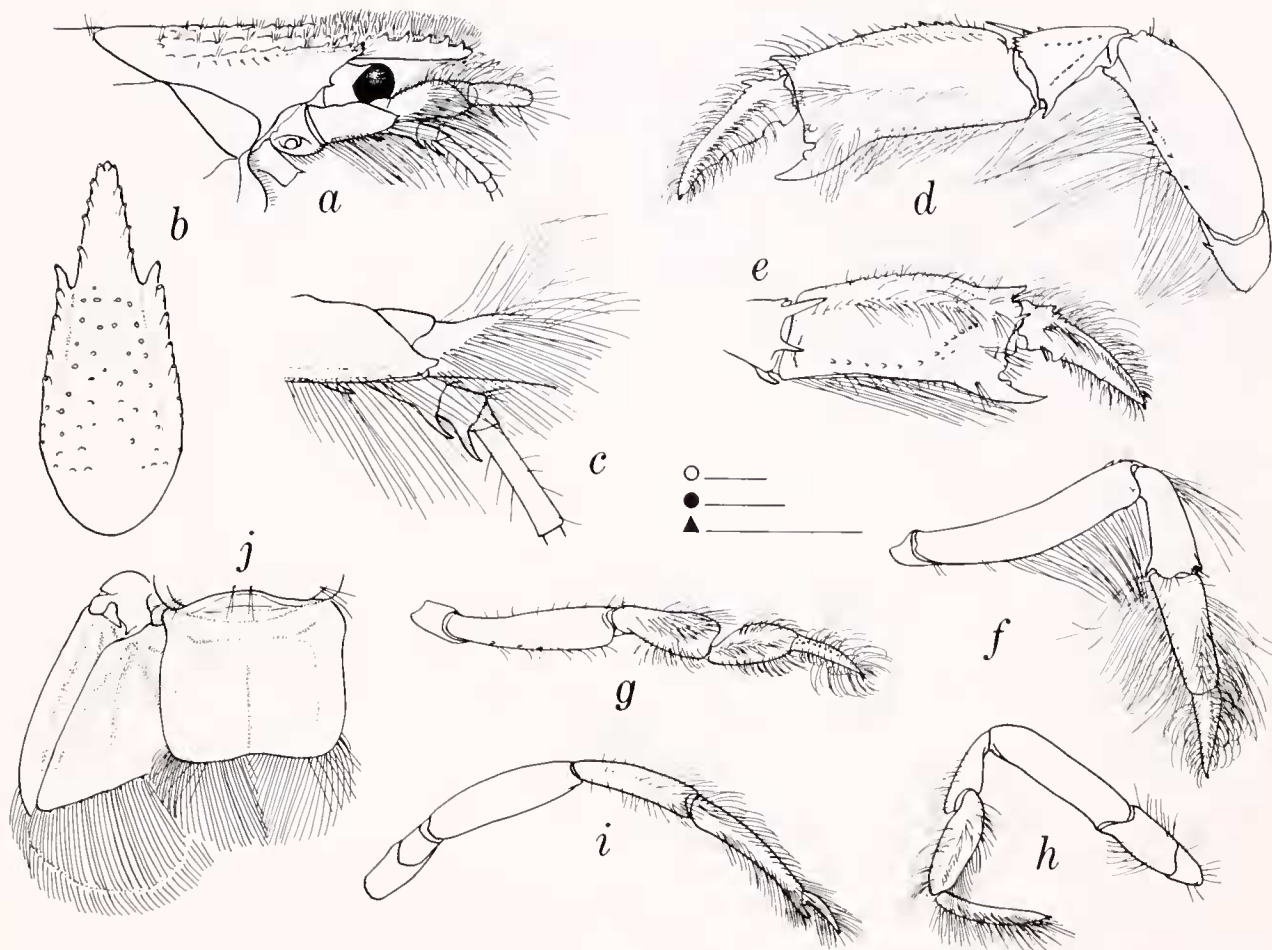


Fig. 8. *Upogebia lepta* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Peduncular articles (part) of antennules and antenna; Cheliped, d, lateral, e, mesial; f, g, h, i, Legs 2–5; j, Telson and left uropods. AHF 2540-01, Paratypes. Scales = 1 mm; ○ = d, e, f, g; ● = a, b, h, i, j; ▲ = c.

becoming obsolescent again near acute spine below mesial condyle of dactyl; mesial surface of palm bearing lunate row of spines, low and more closely spaced in anterior part below above mentioned distal ridge, more widely spaced and prominent proximally but disappearing anterior to granular area on mesioproximal surface; lateral condyle of dactyl unarmed. Fixed finger short, stout, and bearing 1 tooth at proximal  $\frac{1}{3}$  of prehensile edge. Dactyl slightly curved, setose, stouter than fixed finger, and tapered to corneous slender tip; dentate dorsal crest varying from erect at proximal end to obsolescence at mid-length; similar less developed crest laterally; prehensile edge beyond basal lobe sharp and entire except for low proximal tooth and low tooth near middle opposing tip of fixed finger.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus bearing slender, subdistal dorsal and ventral spine; elongate merus with slender subdistal dorsal

spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of obsolescent spines proximoventrally. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with tiny spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae distally; endopod with rather prominent median longitudinal rib and lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing small spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype male, length an-



terior carapace 3.8, length carapace 6.2, length chela including fixed finger 3.7, height chela 1.3. Paratype male, same, 3.2, 5.2, 2.4, 1.0.

*Known range.*—Confined to Santa Catalina Islands, California, and Los Coronados Islands, Baja California Norte.

*Remarks.*—*Upogebia lepta* belongs to the cluster of species which lacks a proximal mesioventral spine on the merus of leg 2. It is relatively more slender than any other species in the eastern Pacific. The shape of the rostrum somewhat resembles that of *U. dawsoni*, including the small size and disposition of marginal teeth, although the ornamented part of the anterior carapace is more extensive than in the latter. *Upogebia dawsoni*, however, is a member of the cluster having a proximal spine on the merus of leg 2.

*Name.*—The name is from the Greek "leptos," thin, small, slender.

*Upogebia longipollex* (Streets)  
Figure 9

*Gebia longipollex* Streets 1871:242.—Lockington 1878:108; 1878:300 (listing).

*Upogebia (Upogebia) longipollex.*—Borradaile 1903: 543.—De Man 1928:23, 35, 39, 51.

*Upogebia spinigera.*—Holthuis 1952:3 (part, synonymy).

*Upogebia rostrispinosa.*—Bott 1955:50 (part).

*Material examined.*—El Salvador:

NMS—2117 (part, Paratype of *U. rostrispinosa* Bott) 1 ♀, Puerto El Triunfo, Peters.

Panama.

USNM—213156, 1 juv., Aguadulce on Golfo de Parita, 8°13.2'N, 80°29.1'W, tidal flats E of town and S of Estero Aguadulce, 0–2 ft, low tide, sandy mud, large rock outcrops, M. L. Jones et al., 24 April 1971, hand net, poison, sieve (with specimens of *U. spinigera*); 213157, 1 ♀, San Carlos, [8°29'N, 79°57'W], under rock in sand at 1.9 ft, L. G. Abele, 4 August 1969; 213158, 1 ♀, ovig., Venado, 12 April 1941; 213159, 4 ♀, Venado Beach about ½ way to Venado Is., W side connecting sandbar, 0–2 ft, low tide, cobble and rock tidepools, 30.5°C, 26‰, Dawson and party, 1505, 4 November 1971, ichthyocide; 213160, 1 ♀, Venado Beach, about ¾ way to Venado Is., tidepools and streams either side connecting sandbar, 0–2 ft, rocks, sandy silt, 28°C, 30.2‰, C. E. Dawson, 1523, 16 January 1972, ichthyocide; 213161, 1 ♀, ovig., Venado Beach along

sandbar to Venado Is., 0–0.6 m, ebb-flood tide, rock, sand, shell and marl, 32°C, Dawson and party, 17 April 1972, 1537, ichthyocide; 213162, 1 ♂, Venado Beach along sandbar to Venado Is., 0–0.8 m, ebb-flood tide, small rocks, sand and silt, 32°C, 34‰, Dawson and party, 1607, 4 April 1973, ichthyocide; 213163, 2 ♀, Fort Kobbe Beach off SW end, 0–0.75 m, low flood tide, rock, sand-muddy inshore, tide-pool among sparse mangrove inshore, 29.5°C, 30‰, Dawson and party, 1587, 3 November 1972, ichthyocide; 213164, 1 ♂, 1 ♀ ovig., Farfan Point, 8°56'N, 79°34'W, 0–1 m, ebb-flood tide, tidepools, mainly sand, some rock and silt, 35°C, 33‰, Dawson and party, 1609, 6 April 1973, ichthyocide, (taken with *U. spinigera*); 213165, 1 ♂, Farfan Point, 8°56'N, 79°34'W, 0–6 ft, deep tidepool, low flood tide, sandy mud, 27‰, Dawson and party, 1506, 5 November 1971, ichthyocide; 213166, 15 ♂, 20 ♀, sorted plus 20 unsorted jaws and frags., Naos Is., rock pile on E side of causeway 0–3 ft, rocks, silty sand to gravel, low tide, C. E. Dawson, 1522, 15 January 1972, ichthyocide (all of these have 3 internal spines on carpus and no spines on merus of P4, there were 3 *U. spinigera* in the collection); 213167, 3 ♀, NE end of causeway to Naos Is., 8°56'07"N, 79°32'47"W, 0–2 in, low flood tide in tidepools, rocks, sand-gravel, C. E. Dawson, 1527, 18 March 1972, ichthyocide (taken with *U. spinigera*); 213168, 2 ♂, rockpile on E side Naos Is. causeway, 0–1 m, low flood tide, sand, sandy marl, small rocks, Dawson and party, 1605, 3 April 1973, ichthyocide; 213169, 1 ♂, 3 ♀, NE end of Naos Is. causeway, 8°56'07"N, 79°32'47"W, 0–6 cm, gravel-sand, low tide, 32°C, Dawson and party, 1604, 3 April, 1973, ichthyocide; 213170, 2 ♀, NE end Naos Is. causeway, 8°56'07"N, 79°32'47"W, 0–6 cm, gravel, sand, cobble, low tide, 30.5°C, 23‰, C. E. Dawson, 1661, 11 November 1973, ichthyocide; 213171, 2 ♂, 6 ♀ (1 ovig.), Naos Is., Scout Beach, 0–1.0 m, low flood tide, rocks, fine mud and sand, Dawson and Overstreet, 1753, 8 January 1978, ichthyocide (1 ♂ atypical); 213172, 1 ♀, Naos Is., causeway, rock pile and sand, canal side, 0–0.13 m, C. E. Dawson, 1772, 21 July 1978; 213173, 2 ♀, San Francisco Reef near Panama City, S. F. Hildebrand, 18 February 1937; 213174, 11 ♂, 7 ♀ (4 ovig.), 5 undet. juvs., Panama reef off French Fort, 8°57'N, 79°31'40"W, rock, sandy silt and gravel, tide pools, low tide, 33.2°C, 30‰, 0–3 ft, Dawson, Dawson and McCosker, 1498, 9 July 1971, Chemfish; 213175, 1 ♂, Panama Reef off French Fort, 8°56'40"N, 79°31'45"W, 0–2 ft, rock, shell, pebbles, low tide, 33°C, 30‰, Dawson, Dawson and McCosker, 1499, 10 July 1971, Chemfish (with *U. spi-*

*nigera*); 213176, 1 ♀, Panama reef off French Fort, 8°56'45"N, 79°31'45"W, 0–2 ft, rock, tidepools, silt and gravel, low tide, 32°C, 25‰, Dawson and party, 1507, 6 November 1971, ichthyocide (3 ♀ *U. spinigera* taken with this); 213177, 1 ♂, Panama Reef off French Fort, 8°56'45"N, 79°31'45"W, 0–1 m, tidepools ebb-flood, rock, sand, gravel, 28°C, 34‰, Dawson and party, 1538, 18 April 1972, ichthyocide (with *U. spinigera*); 213178, 2 ♀, Whorehouse Reef, Panama City, pools, rock, cobbles, sand, 28°C, 34‰, Dawson, Dawson, and Jones, 92-5, 18 April 1972, poison; 213179, 1 ♂, Bay W of Punta Paitilla approx. 8°58'15"N, 79°31'30"W, 0–3 ft in tidal pools and among rocks, C. E. Dawson, 2004, 4 December 1966, Pro-noxfish and Chemfish; 213180, 4 ♂, 2 ♀, Punta Paitilla, E side, rock channels and tidepools 0–1.3 m, 34°C, 27‰, Dawson and party, 1602, 1 April 1973, ichthyocide (taken with *U. spinigera*); 213181, 1 ♂, 9 ♀ (3 ovig.), Bella Vista, out of log, 7 February 1941 (taken with many *U. spinigera*, mature); 213182, 1 ♀ (ovig.), Bella Vista, shore collecting, AHF445-35, 2 February 1935; 213183, 1 ♂, Bella Vista, date unknown; 25236, 1 ♀, ovig., Panama, H. A. Ward, exchange, 1891.

#### Ecuador.

USNM—213184, 1 ♂, Isla Puna, shore, freshwater, W. L. Schmitt, AHF 363-35, 23 December 1934.

**Diagnosis.**—Postocular spine present. Abdominal segments 1–2 almost always bearing spines or spinules on sternites, margin of pleura and bases of pleopods; dorsal surface of uropods and telson often strewn with numerous spinules. Telson essentially rectangular. Merus of leg 2 bearing proximal mesioventral spine but that of legs 3 and 4 spineless.

**Description.**—Rostrum triangular, short, straight, tip extending to distal edge of eyestalks; pair of strong subapical dorsal spines followed on each side by 2 spines of almost equal size; its slightly tuberculate central dorsal surface bearing tufts of setae, merging with similar surface over anterodorsal  $\frac{2}{3}$  of carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing crest of about 11 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, shoulder lateral to it often bearing tiny, scattered, deciduous, corneous spinules and a few small tubercles below intersection with thalassinidean line; latter continuing to posterior margin of carapace through variably calcified dorsolateral field

strewn with often numerous tiny spinules. Postocular spine present.

Abdomen broadly and smoothly arched dorsally, with dense fine plumose setae on posterior margin of tergites 2–4 and in tracts on pleura of segments 2–5; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded; pleural margin of segments 1–2 bearing deciduous spinules; sternum bearing very short, rather broad based acute spines, most noticeable on sternites 1–2; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long but broadest proximally; angle on anterolateral margin interlocking with groove on central rib of uropodal endopod; distal margin slightly concave medially and densely fringed with setae; transverse anterior ridge fairly prominent and continuous with low lateral ridge at each side; sometimes spiny; these and most of dorsal surface (occasionally glabrous) usually bearing short, deciduous spinules; median groove obsolescent.

Eyestalk stout, deepest at about midlength, convex and setate ventrally; cornea narrower than diameter of stalk and directed anterolaterally, sometimes bearing low papilliform projection near mesial margin.

Antennular peduncle reaching to about proximal  $\frac{1}{3}$  of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus somewhat longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval, with minute terminal spine.

Mouthparts as figured; maxilliped 3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing 2 spines (occasionally 1 obsolescent) at anterolateral angle.

Chelipeds essentially equal. Ventral margin of ischium bearing 1 small spine. Merus with single subdistal dorsal spine reaching level of postocular spine, row of as many as 4 small to moderate spines on proximal  $\frac{2}{3}$  of ventral margin. Carpus trigonal, with shallow longitudinal groove laterally and strong spine at ventrolateral corner, mesiodorsal crest of almost uniform small spines behind prominent spine on anterior margin, all directed forward; comb of about 4 spines lateral to latter on anterior margin and 2 strong spines below it on distomesial margin, ven-



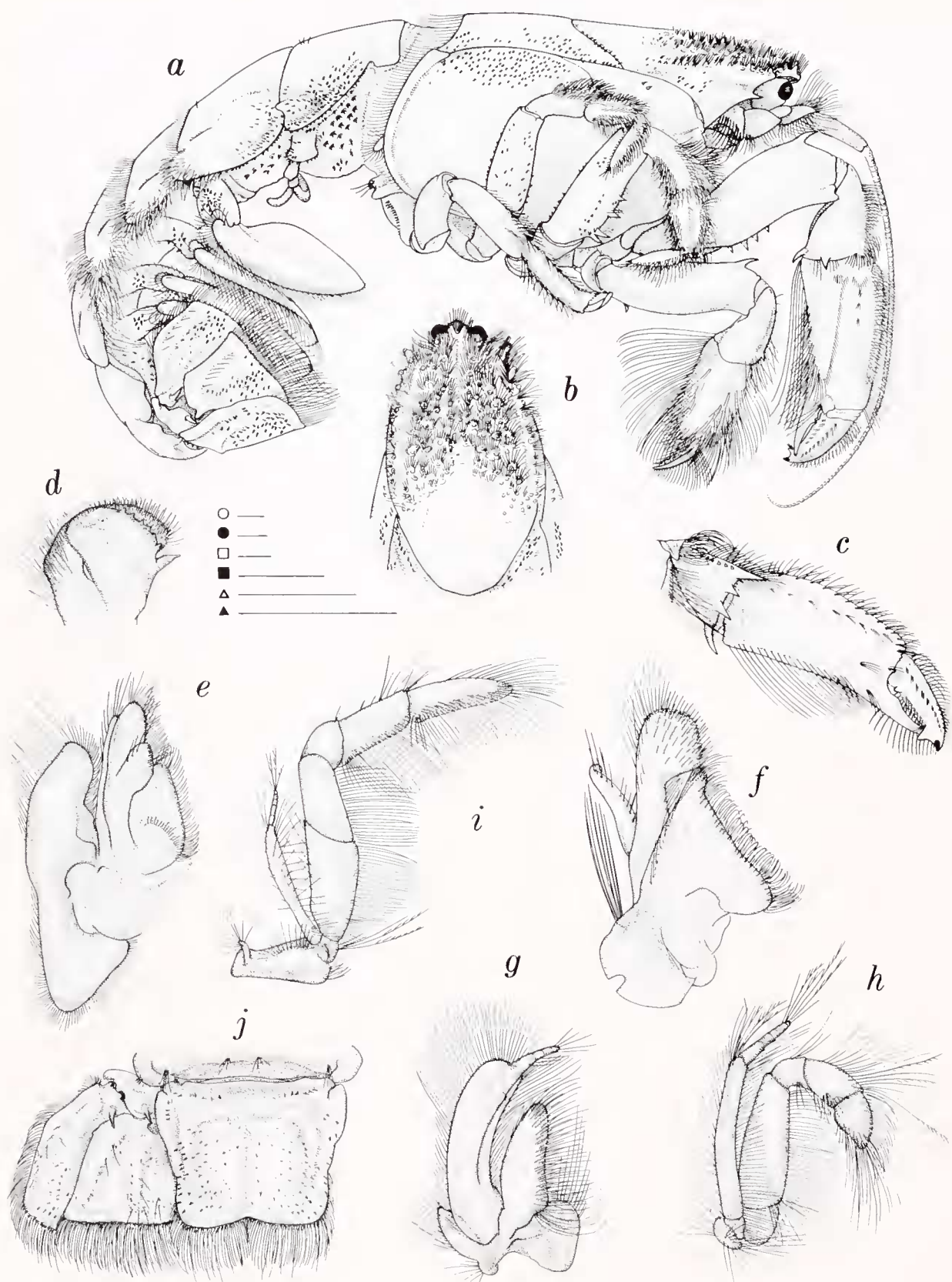


Fig. 9. *Upogebia longipollex* (Streets). a, Female, lateral; b, Anterior carapace, dorsal; c, Chela and carpus, mesial; d, Mandible; e, f, Maxilla 1, 2; g, h, i, Maxilliped 1, 2, 3; j, Telson and left uropods. USNM 213173, ♀; mouthparts from USNM 213181. Scales = 1 mm; ○ = a, c; ● = b; □ = j; ■ = e, g, h, i; △ = f; ▲ = d.



tral one largest; distoventral spine strong. Palm oval in cross section, length including fixed finger about 3 times maximal height; prominent setae in 3 dorsal rows and fewer in mesial row; dorsal crest of spiniform tubercles flanked on each side by spineless crest; lateral condyle of dactyl with obsolescent spine below it, mesial condyle with variable number of tiny spines below it on anterior margin of palm; mesioproximal surface bearing granular vertical ridge. Fixed finger about  $\frac{3}{4}$  length of dactyl, depending on wear, slightly curved and tapering to moderately acute tip reaching level of strong subdistal tooth of dactyl, usually 2 pairs of moderate teeth on prehensile edge proximally. Dactyl slightly curved and stouter than fixed finger, rather acute corneous tip preceded by strong calcareous tooth on prehensile edge and then ridge capped by row of about 7–8 small teeth and a larger more remote one next to toothless proximal part. Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus with acute but small distodorsal spine and blunter subdistal ventral spine; merus with strong mesioventral, proximal spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of ventral and ventrolateral spines, coxa with spine lateral to oviduct opening in female. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Uropod with spine on protopod overhanging base of endopod; one or both rami usually bearing scattered deciduous, minute, corneous spinules on exposed surface; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute scattered spines and dense fringe of setae on distal margin; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing strong spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Male, length anterior carapace 7.2, length carapace 11.1, length chela including fixed finger 7.0, height chela 3.2. Oviparous female, same, 8.6, 12.4, 7.7, 2.6.

*Type-locality.*—Isthmus of Panama (Pacific side).

*Known range.*—El Salvador to Ecuador.

*Remarks.*—The status of Streets's species has long been in doubt because the description was inexplicit, and the holotype is lost. Lockington (1878) and Borradaile (1903) merely reiterated its occurrence, but de Man (1928) remarked that Streets's species was probably identical with *U. spinigera* (Smith) and Holthuis (1952) concurred, both authors pointing out apparent agreement between these two forms in

all particulars except for Streets's statement that legs 3–5 of his species were unspined. De Man suggested that spines on these appendages might not yet have been developed in an animal of the size that Streets described (28 mm total length).

Now, abundant material from Pacific Central America shows that there are two similar species in the region: *U. spinigera* with at least some spines on the merus of leg 4, often well developed on animals even smaller than the specimen seen by Streets; and another species (*U. longipollex*) which shares many characters with *U. spinigera*, but with the merus on leg 4 spineless at sizes ranging from smaller than that seen by Streets to larger than any specimen of *U. spinigera* seen by me. Paradoxically, the species with no spines on the merus of leg 4 is spinier in other respects than the true *U. spinigera*, having rather stout spinules on the sternites of abdominal segments 1–2 as well as numerous slender corneous spinules on the pleura of those segments, on basal articles of the pleopods, often thickly strewn over the upper surfaces of the tail fan, and on the carapace along the calcified dorsolateral tract traversed by the thalassinidean line. Aside from these differences, others are pointed out in the descriptions and the key to identification of species.

A fruitless search for Streets's type in the invertebrate collection at the Academy of Natural Sciences of Philadelphia was recently made at my request by both S. L. H. Fuller and R. H. Gore, and from that one must conclude that the specimen is lost. Since the locality given was simply "Isthmus of Panama," a question remains as to where J. A. McNeil collected his material, the Pacific or the Atlantic side. There is no way to settle this, but we do know that the type-series of *U. spinigera* collected by him came from the Pacific side (see account for that species). Log books of the USS *Narragansett* in the National Archives and Record Service, Record Group 37, Records of the U.S. Hydrographic Office, show that vessel to have worked in Pacific waters and that T. Hale Streets was its Asst. Surgeon from 22 July 1874, until at least 6 May 1875. However, that is later than the date of publication for *U. longipollex*. There is no record of McNeil associated with the vessel, but the logs name only officers.

#### *Upogebia maccraryae* new species

Figure 10

*Upogebia rostrispinosa* Bott 1955:50 (part).

*Material examined.*—El Salvador.

NMS-2117 (part, Paratypes of *U. rostrispinosa* Bott) 1 ♂, 2 ♀, Puerto El Triunfo, Peters.

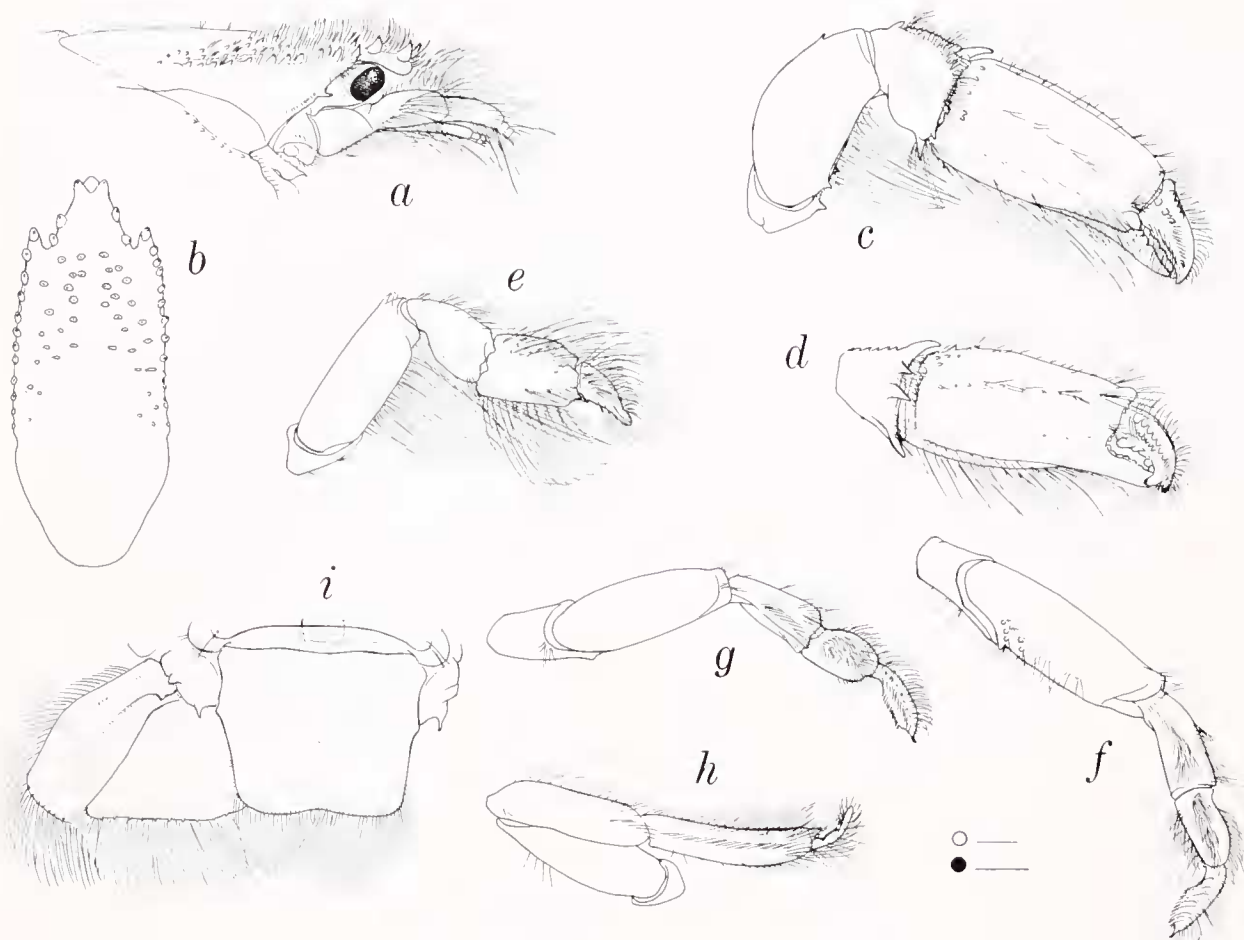


Fig. 10. *Upogebia macrariae* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2-5; i, Telson and left uropods. USNM 213203, ♂ Paratype. Scales = 1 mm; ○ = c, d; ● = a, b, e, f, g, h, i.

#### Panama.

USNM—213206, 2 ♂, ca. 2 mi from Punta Pala, Golfo de Panama, wood burrowing "callianassids" from piece of rotten wood, mud button with leaf cover, 3 fm, L. G. Abele, 22 February 1969.

#### Ecuador.

AHF—2568-01 (Paratype 6813) 1 ♂, Guayaquil, from mud in mangrove swamp, D. P. Abbott, *Te Vega Exped.* XVIII, 4 April 1968.

USNM—213202 (Holotype) ♀, Isla Puna, Golfo de Guayaquil, shore, freshwater, AHF 363-35, W. L. Schmitt, 23 December 1934; 213203 (Paratypes) 2 ♂, 16 ♀ (6 ovig.), same; 213204 (Paratypes) 1 ♂, 2 ♀ (1 ovig.), Playas, A. McCrary, No. 61, 4 June 1974; 213205 (Paratypes) 2 ♀ (1 ovig.), Puerto de El Morro, mangrove swamp, A. Vincent, 1 June 1975.

*Diagnosis.*—Postocular spine present and occasionally double. Rostrum with extremity equal to

or exceeding that of eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with palm spineless mesially posterior to base of fixed finger; ischium with 0-1 small spine(s) on ventral margin. Leg 2 without proximal mesioventral spine on merus; merus of leg 4 lacking ventral spines.

*Description.*—Rostrum broadly triangular, slightly downturned; tip exceeding pair of moderate, sub-apical dorsal spines situated more or less side by side and followed after an interval on each side by 2 spines of about equal size; central dorsal rostral surface bearing tufts of setae but almost spineless, merging with pilose field of spiniform tubercles, diminishing over approximately  $\frac{1}{2}$ – $\frac{3}{4}$  of anterodorsal carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 9-15 elements decreasing from spines on lateral ros-

tral process to obsolescence posteriorly. Cervical groove deep and continuous, rather sharp shoulder lateral to it bearing 0–10+ granules (sometimes obsolescent) below level crossed by thalassinidean line, latter continuing to posterior margin of carapace. Postocular margin sometimes slightly irregular, bearing spine, occasionally dual.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae in tracts on pleura of segments 3–5 and similar tuft on posterolateral corner of 2; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, sides slightly lobed proximally, distal margin shallowly biarcuate and densely fringed with setae; transverse anterior ridge strong, continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk reaching to between level of subdistal dorsal spines on rostral margin and tip; more or less angled upward, swollen ventrally, often with 1 or more dorsal tubercles proximal to good sized terminal cornea directed somewhat ventrolaterally.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 bearing variably prominent, subdistal ventral spine; scale moderate and tipped with 1 or more setae.

Mouthparts as figured for *U. pugettensis*; maxilliped 3 bearing epipod.

Epistomial projection broad in lateral view, bearing single small spine.

Chelipeds essentially equal, slender to moderate. Ventral margin of ischium bearing 1 short spine. Merus with 1 or 2 obsolescent spines on ventral margin; subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, a shallow longitudinal groove laterally, and an obsolescent spine at anterior ventrolateral corner; mesiodorsal crest of forwardly directed uniform (sometimes obsolescent) spines behind and rather remote from prominent spine on anterior margin; latter flanked by remote cluster of 2–4 tiny to moderate spines on anterodorsal margin and followed below on distomesial margin by 2 small-moderate spines, ventral one largest; distoventral spine strong. Palm oval in cross section,

length in female including fixed finger about 3.2–3.6 times maximal height, depending on size, stouter in male; prominent setae in 4 dorsal rows, longer in ventral tract, some setae along low lateral ridge, and tufts distally; dorsal crests usually low and spineless in female, some low proximal spines in male; lateral condyle of dactyl with small spine below it; mesioproximal surface bearing low granular ridge. Fixed finger sometimes nearly as long as dactyl, slender and gently curved in female, stouter and straighter in male, with rather abruptly tapered tip; about 3 teeth on proximal part of prehensile edge. Dactyl slightly curved, setate, stouter than fixed finger, and tapered to corneous slender tip; dentate crest of small teeth on prehensile edge terminated at each end by larger tooth, that at subdistal end opposing tip of fixed finger.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus smooth; elongate merus with slender subdistal dorsal spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of obsolescent spines proximovertrally. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with weak spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, each with dense fringe of setae distally; endopod with rather prominent median longitudinal rib and lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing rather blunt spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype female, length anterior carapace 7.2, length carapace 10.4, length chela including fixed finger 5.8, height chela 1.9. Paratype male, same, 6.9, 10.1, 7.2, 2.8.

*Known range.*—El Salvador to Ecuador.

*Remarks.*—This species is closest to *U. brasiliensis* from the western Atlantic, differing from it mainly in having more granules on the shoulder lateral to the cervical groove. Among eastern Pacific species it seems closest to the much smaller *U. veleronis*. These three species usually have reduced spines on the chelipeds, especially on the dorsal crest of the carpus and along the ventral margin of the ischium and merus.

There is variation in placement of spines on the



rostrum and in its shape and curvature in lateral profile in *U. macrariae*, and occasionally there is a small subdistal spine on the ventral side. One specimen examined has unequal mesial spines on the anterior margin of the carpus of the cheliped, three on one side, two on the other. Four of the males examined seemingly have oviducal openings developed on the coxae of the third legs (false hermaphrodites) but lack the first pair of pleopods, and one of these bears a bopyrid parasite in the right branchial chamber.

The specimens from rotten wood in the Panama area are immature, lack granules on the shoulder flanking the cervical groove, and may represent a considerable divergence from typical *U. macrariae*.

*Name*.—This species is named for Anne B. McCrary, Department of Biology, University of North Carolina–Wilmington, who collected it along with many other crustaceans during field work in Ecuador, and who first drew my attention to undescribed species in the eastern Pacific.

*Upogebia macginitieorum* new species  
Figure 11

*Gebia pugettensis*.—Lockington 1878:300 (part, Bahía de San Quintín, Baja California Norte).

*Upogebia pugettensis*.—Rathbun 1904:153 (part, Baja California material).—MacGinitie 1930:37 (part, Newport Bay, California, material).—MacGinitie and MacGinitie 1949:292 (part, southern California material).—Frey 1971:9–10 (part).—Brusca 1973:223; 1980:159 (part, “the blue mud shrimp” in Baja California, not from Elkhorn Slough, California, northward).—Allen 1976:13, 37, 232 (list and key), pl. 30, figs. 363, 364.

*Upogebia (Upogebia) pugettensis*.—De Man 1929: 120 (Bahía de San Quintín material, distribution).

*Upogebia* cf. *pugettensis*.—Anonymous 1972:9–10, 7 unnumbered figs.

*Upogebia* aff. *pugettensis*.—Homziak 1981:943 (abstract).

*Material examined*.—USA: California.

AHF—2569-01, 1 ♂, 3 ♀ (ovig.), Anaheim Bay [incomplete locality data]; 2542-01 (Paratype 4132), 7 ♂, 8 ♀ (3 ovig.), Isthmus Catalina Harbor, Santa Catalina Is. 33°25'55"N, 118°30'05"W, shore, mudflats at low tide, *Velero III* sta. 1368-41, 19 June 1941; 2542-01, 7 ♂, 10 ♀ (2 ovig.), Mission Bay, 1929; 2570-01, 1 ♂, Mission Bay, *Velero III*, 29

November 1940; 2571-01, 2 ♂, 1 ♀, Mission Bay, 27 December ?

SDNHS—230, 1 ♀, La Jolla, 1934; 3988 (Paratypes) 2 ♀, La Jolla, J. S. Higgins, 2 September 1938; 3989 (Paratype) 1 ♂, La Jolla; 3990 (Paratype) 1 ♀, Mission Bay, J. S. Higgins, 12 March 1935; 4008, 1 ♂, Glorietta Bay, Coronado Bay, San Diego, with razor clams, Fritz, October 1971.

SIO—C2881, 1 ♀, Mission Bay, San Diego, A. Fast, 23 February 1963; C2884 (Paratypes) 2 ♂, 2 ♀, Crown Point, Mission Bay, San Diego, P. W. Johnson, 14 October 1955.

USNM—89485, 2 ♀ (1 ovig.), Newport Bay, the MacGinities, 4 April 1935; 213214, 1 ♀, Balboa, 15 December 1914; 213215, 4 ♂, 9 ♀, Balboa, S. A. Glassell, 12 November 1932; 23410, 2 ♂, 3 ♀, Catalina Harbor [and Monterey], sandy mud, W. H. Dall (c.6, 36, 44, 45, 47); 28332, 7 ♂, 6 ♀ (3 ovig.), Catalina Harbor [or Monterey Bay], some in poor condition, W. H. Dall, c.86, 44, 45, and 47; 213216, 1 ♂, La Jolla, 1934; 105363, 1 ♀ (ovig.), Mission Bay, 32°47½'N, 117°14'W, R. Gooding, 28 March 1956; 18668, 1 ♀ (ovig.), mouth of Tijuana River, San Diego Co., E. H. Mearns, no. 1606, 17 July 1894; 213217 (Paratypes) 1 ♂, 2 ♀ (ovig.), Tijuana Slough, ca. 2½ mi N US-Mexican border, water table depth at edge of *Salicornia* growth, sediment corer, J. Homziak, A. B. & J. Williams, D. Dexter, 17 August 1976; 213218 (Paratype) 1 ♂, Tijuana Slough, ca. 2½ mi N US-Mexican border, edge of *Salicornia* growth in mud, sediment corer, J. Homziak, A. B. & J. Williams, D. Dexter, 17 August 1976; 213219 (Holotype) ♀, Tijuana Slough, ca. 2½ mi N US-Mexican border, 15-inch depth from mud along cut bank above mid tide level, sediment corer, J. Homziak, A. B. & J. Williams, D. Dexter, 17 August 1976; 213220 (Paratypes) 3 ♂, 3 ♀ (1 thorax only), same, (with *Phyllodurus abdominalis*); 84371, 1 ♂, California, no. 418 Kingsley collection, Lockington.

*Diagnosis*.—Postocular spine absent or at most obsolescent. First and/or second abdominal segment lacking ventral spines. Telson essentially rectangular. Cheliped without spine on curved dorsal margin of merus. Leg 2 without mesioventral spine on merus; leg 3 with few obsolescent proximoventral spines on merus, carpus with spine on distodorsal margin flanked by lateral marginal spines.

*Description*.—Rostrum triangular, straight, exceeding eyestalks; ventral border spineless and curved gently upward to tip; pair of short subapical spines well back of tip followed on each side by 4 small conical teeth, dorsal teeth near midlength of each side, merging with field of spines and tubercles

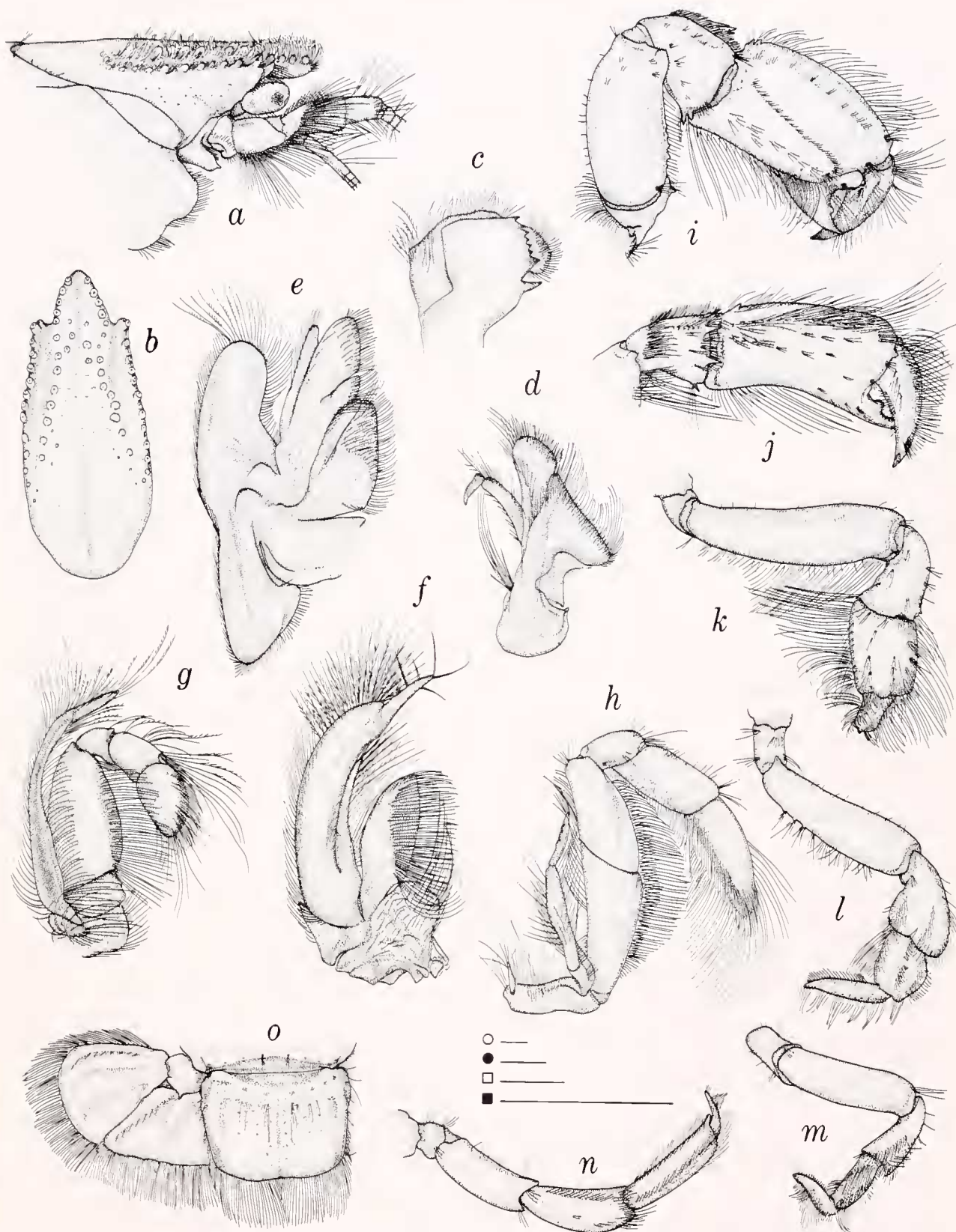


Fig. 11. *Upogebia macginitieorum* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, l, m, n, Legs 2-5; o, Telson and left uropods. USNM 213217, ♂ Paratype; mouthparts from USNM 213220. Scales = 1 mm; ○ = a, b, k, l, m, n; ● = o, i, j; □ = d, e, f, g, h; ■ = c.



diminishing in size over anterior dorsal part to obsolescence and angling posterolaterally to end at about  $\frac{2}{3}$  distance from rostral tip; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 11–12 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, shoulder lateral to it fairly prominent and obscurely spined anteriorly; thalassinidean line continuing to posterior margin of carapace. Postocular spine absent or at most obsolescent.

Abdomen broadly and smoothly arched dorsally, dense fine plumose setae laterally on posterior margin of segments 3 and 4 and in tracts on pleura of segments 3–5; sterna of segments 1–2 spineless; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded; margin of pleura unspined; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long, broadest proximally; angle on anterolateral margin interlocking with groove on central rib of uropodal endopod; distal margin slightly indented medially and densely fringed with setae; transverse anterior ridge fairly prominent and continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk clearly exceeded by rostrum; more or less cylindrical, cornea narrower than basal part of stalk, directed anterolaterally.

Antennular peduncle reaching to between base and midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as slender terminal article; flagella unequal, lower thinner ramus clearly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing small subdistal ventral spine; scale moderate, oval, with obsolescent dorsal spine and sometimes with minute terminal spine.

Mouthparts as figured; maxilliped 3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing 1 spine at anterolateral angle.

Chelipeds essentially equal. Ventral margin of ischium bearing 1 small spine. Merus with scattering of small ventral spines. Carpus trigonal, with shallow longitudinal groove laterally and diagonal row of plumose setae dorsally; strong, slender anteromesial spine preceded by mesiodorsal crest of al-

most uniform small spines and flanked laterally by row of anterodorsal spines diminishing in size laterally, all directed forward; 1 strong spine on anterior margin mesially; anteroventral spine strong. Palm more or less compressed but convex on lateral surface, length including fixed finger about 2.2–2.7 times maximal height, depending on size; prominent setae in 4 dorsal rows, longer in ventral tract, some setae along low lateral ridge, incomplete dorsal crest of low forwardly directed spines flanked on each side by spineless crest; lateral condyle of dactyl with obsolescent spine below it, mesial condyle with stout spine below followed by 4 or 5 small teeth on distal margin of palm; mesioproximal surface bearing granular vertical ridge. Fixed finger about  $\frac{1}{2}$  length of dactyl, slightly curved and tapered to moderately slender tip in female, stouter in male, and 3–5 teeth on prehensile edge proximally. Dactyl slightly curved and stouter than fixed finger, corneous slender tip preceded by low tooth on prehensile edge and then a row of about 7 calcareous teeth ending in strong tooth near proximal diastema; 2 rows of obscure tubercles mesially and a row of tubercles with scattered outliers proximally on dorsal surface. Leg 2 having carpus with acute distodorsal spine and stronger subdistal ventral spine; legs 2–5 otherwise spineless and with usual setose tracts. Leg 2 with propodus and dactyl reaching beyond rostrum; leg 3 with slender pointed dactyl extending beyond rostrum; leg 4 with dactyl reaching distal edge of eye, and leg 5 reaching beyond base of cheliped.

Two arthobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute scattered spines on distal margin and dense fringe of setae; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing rather blunt spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved but shallowly concave proximally.

*Measurements (mm).*—Male, length anterior carapace 14.1, length carapace 20.7, length chela including fixed finger 12.8, height chela 6.4. Ovigerous female, same, 14.1, 22.1, 10.0, 4.5.

*Color.*—Similar to *U. pugettensis*.

*Habitat.*—Living much higher in relation to tide and in greater aggregations than *U. pugettensis*.



(MacGinitie and MacGinitie 1949). Restricted to clay bank habitat in Tijuana Slough, California (Homziak 1981).

*Known range*.—Santa Catalina Island, Newport Bay, to Tijuana Slough, California.

*Remarks*.—Though this species has long been confused with *U. pugettensis* (see below), its relationships seem closer to *U. tenuipollex*, a species described herein which also lacks the postocular spine.

*Name*.—The species is named for G. E. and N. MacGinitie who recognized its differences from *U. pugettensis* in 1949 and summarized what is known of its biology.

*Upogebia onychion* new species

Figure 12

*Material examined*.—USA: California.

AHF—2544-01 (Holotype 4133) ♀, 1½ mi E Cardwell Point, San Miguel Is., 34°00'55"N, 120°16'30"W—34°00'45"N, 120°15'W, 21 fm, sand, fl. rocks, brittle stars, *Velero III* sta. 1415-41, Blake trawl, 16 September 1941.

USNM—213279 (Paratype) ♀, same.

*Diagnosis*.—Postocular spine present. Rostrum with extremity slightly exceeding that of eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with fixed finger less than ½ as long as dactyl; palm spineless mesially proximal to base of fixed finger; ischium with 1 small spine on ventral margin. Leg 2 without proximal mesioventral spine on merus; merus of leg 4 lacking ventral spines.

*Description*.—Rostrum broadly triangular, straight and very slightly downturned; tip imperceptibly exceeding pair of moderate, subapical dorsal spines situated more or less side by side and followed on each side by 2 equidistant spines of about equal size; central dorsal rostral surface bearing tufts of setae and almost spineless, merging with setose field of rather sparsely distributed spiniform tubercles and tubercles diminishing over approximately ⅔ of anterodorsal carapace and angling toward sides posteriorly; gastric region posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of 8–9 elements decreasing from spines on lateral rostral process to obsolescence posteriorly. Cervical groove moderate and continuous, shoulder lateral to it smooth; thalassinidean line continuing to posterior margin of carapace. Postocular margin bearing spine.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae in tracts on pleura of segments 3–5 and tuft on posterolateral corner of 2 and anterolateral corner of 6; latter segment rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, sides slightly lobed proximally, distal margin shallowly biarcuate and densely fringed with setae; transverse anterior ridge strong, slightly granular, continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk reaching to level between distalmost and penultimate dorsal spines on rostral margin, base larger than stalk, in lateral view somewhat convex ventrally, concave dorsally; cornea good sized, terminal.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about ⅓ its length extending beyond tip of rostrum; article 2 lacking subdistal ventral spine; scale moderate.

Mouthparts as figured for *U. pugettensis*; maxilliped 3 bearing epipod.

Epistomial projection broad in lateral view, bearing single small spine.

Chelipeds essentially equal, moderately stout. Ventral margin of ischium bearing 1 small spine. Merus with 4 spines on ventral margin; subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, a shallow longitudinal groove laterally, obsolescent spine at anterior ventrolateral corner preceded by low ridge bearing obsolescent spines; mesiodorsal crest of obsolescent spines behind prominent spine on anterior margin; latter flanked by remote cluster of 3–4 tiny spines on anterodorsal margin and followed below on distomesial margin by small spine; distoventral spine small. Palm oval in cross section, length on female including fixed finger about 2–2.4 times maximal height; prominent setae in indefinite dorsal rows, longer in ventral tract, patch of setae laterally near base of fixed finger, and tufts distally; dorsal crests low and spineless. Fixed finger less than ½ as long as dactyl, stubby, with shallowly concave corneous tip; 1 or 2 ill-defined teeth on proximal part of prehensile edge. Dactyl slightly curved, setose, slightly stouter than fixed finger at base, and tapered to corneous slender tip;

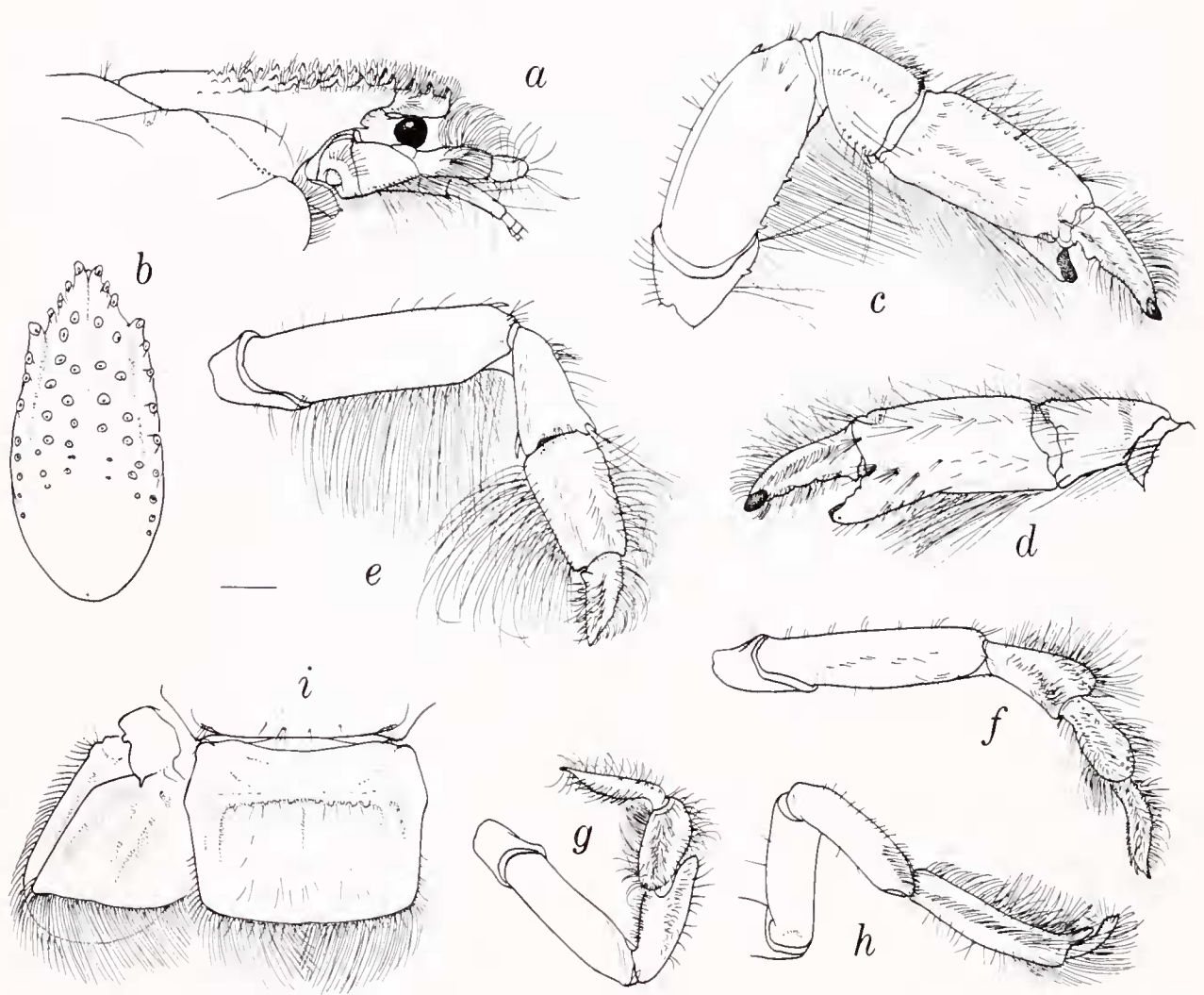


Fig. 12. *Upogebia onychion* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2-5; i, Telson and left uropods. AHF 2544-01, ♀ Holotype. Scale = 1 mm, all figures.

1 low tooth near proximal end of prehensile edge opposing tip of fixed finger.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus with subdistal dorsal and ventral spine; elongate merus with slender subdistal dorsal spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus spineless proximovertrally. Leg 4 with spineless merus and very slender pointed dactyl. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1-4.

Uropod with tiny spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae distally; endopod with rather prominent median longitudinal rib and lat-

eral rib having margin with short straight to slightly convex proximal and longer distal sectors meeting at obtuse proximal shoulder; exopod with 3 ribs, mesial strongest one bearing obsolescent tubercle proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm.)*—Holotype female, length anterior carapace 4.5, length carapace 7.2, length chela including fixed finger 3.2, height chela 1.3. Paratype female, same, 4.0, 6.4, 2.6, 1.3.

*Known range.*—Confined to type-locality.

*Remarks.*—In possession of a short, stout fixed finger with corneous tip on the chela, *U. onychion* is unique among east Pacific species of *Upogebia*. It is similar to *U. pugettensis* in lacking spines on the palm of the chela, a proximal mesioventral spine

on the second leg, spines on the merus of the third leg, and in possession of a postorbital spine.

*Name*.—A noun in apposition from the Greek “onychion,” diminutive for nail or claw, with reference to the shortened fixed finger with tip bearing corneous, nail-like prehensile edge.

*Upogebia pugettensis* (Dana)

Figure 13

*Gebia pugettensis* Dana 1852:510, pl. 32, figs. 1a–d.—Lockington 1878:299 (part, Monterey Bay, California, northward).

*Gebia pugettensis*.—Dall 1899:880, pl. 87, fig. 4 (bivalve parasite).

*Upogebia pugettensis*.—Rathbun 1904:153 (part, California material).—Schmitt 1921:115, fig. 77.—Johnson and Snook 1927:327–330, figs. 274, 277D.—Stevens 1928:318, 345 ff., figs. 1–5, 20–37; 1929:400–405, figs. 1, 3.—MacGinitie 1930:36 ff. (part, from Elkhorn Slough, California northward), pls. 1–3.—Hart 1937:183–184, 197–202, figs. 5A–E, 6A–O.—Ricketts and Calvin 1939, 1948:179, 227–228, pl. XLIV; revised ed. 1952:233, 313–314, pl. XLIV; fourth ed. 1968:344–346, fig. 255.—Light 1941:113 (key).—MacGinitie and MacGinitie 1949:291–292 (part, from Elkhorn Slough, California, northward), figs. 135–137.—Smith et al. 1954:183 (key), 365 (habitat).—Schmitt 1965:136–137, fig. 56.—L. C. Thompson and Pritchard 1969:114–129 (passim).—R. K. Thompson and Pritchard 1969:274–278 (passim).—Frey 1971:9–10 (part).—Thistle 1973:23 (key).—Brusca 1973:223; 1980:259 (part, from Elkhorn Slough, California, northward).—Abbott 1974:471, fig. 5435 (reprod. Dall's fig.).—Kozloff 1974:168 (key).—Powell 1974:28–38.—Carlton and Kuris 1975:401 (key), 409.—Coan and Carlton 1975:pl. 132, fig. 70 (reprod. Dall's fig.).—Kuris 1975:382–383, figs. 12A, B.—Brusca and Brusca 1978:86, 89.—Pritchard and Eddy 1979:249–253 (passim).—Haig and Abbott 1980:579, pl. 166, fig. 24.1 (colored).

*Upogebia (Upogebia) Pugettensis*.—de Man 1928:23 (distribution in part).

*Upogebia (Upogebia) pugettensis*.—de Man 1929:120 (not Bahía de San Quintín material), figs. 6–6d.

*Material examined*.—Canada: British Columbia.

CAS 2094, 3 ♂, 1 ♀, Departure Bay, Vancouver Island; W. Thompson.

USNM—31875, 1 ♂, 5 ♀, Gabriola Is., Taylor Bay, U.S. Fish Comm. Str. *Albatross*, 20 June 1903; 28334

1 (mutilated) Lucia Is., Seymour Narrows, U.S. Fish Comm. Str. *Albatross*, 6 May 1894; 19300, 10 ♂, 5 ♀, Comox, U.S. Fish Comm. Str. *Albatross*, 1893; 28339, 4 ♂, 5 ♀ (1 ovig.), Comox, U.S. Fish Comm. Str. *Albatross*; 31874, 16 ♂, 12 ♀, Union Bay, U.S. Fish Comm. Str. *Albatross*, 22 June 1893; 213275, 1 ♀, Union Bay, Baynes Sound, U.S. Fish Comm. Str. *Albatross*, 15 May 1906, bearing 2 isopods, *Phyllodurus abdominalis* and clam *Neaeromya rugifera*; 189480, 1 ♂, Union Bay, E of coal wharf, W. Schmitt, 27 May 1911; 213277, 1 ♀, 8 mi N Qualicum, beach under rocks, E. F. Ricketts, 8 August 1930; 40073, 1 ♂, Ucluelet, Biological Station, Departure Bay, Vancouver Is., in mud; 28336, 1 ♀, Departure Bay, Vancouver Is., U.S. Fish Comm. Str. *Albatross*, 2 August 1889; 189479, 1 ♂, Departure Bay, from burrow, 15 August 1957; 28338, 1 ♀, Nanaimo, U.S. Fish Comm. Str. *Albatross*; 28337, 9 ♂, 5 ♀ (1 ovig.), Otter Bay, Pender Is., U.S. Fish Comm. Str. *Albatross*, 13 May 1895; 155947, 1 ♂, Safety Cove, Calvert Is., muddy sand flats, 12 June 1937; 189478, 1 ♀, Safety Cove, Calvert Is., muddy sand flats, eel grass, T. T. and E. B. McCabe, 13 June 1937.

USA: Alaska.

USNM—189482, 1 ♂, Sawmill Bay at inner end of Prince William Sound about 20 mi from Valdez, intertidal, Feder, April 1971; 31876, 1 ♀, Freshwater Bay, Bur. Fish. Str. *Albatross*, 20(?) June 1903; 213273, 1 ♀, Humpback Bay, littoral, sand flats, shell, rocks; W. W., 19 August 1937; 28331, 1 ♂, 1 ♀, Union Bay, Cleveland Peninsula, U.S. Fish Comm. Str. *Albatross*, 4 September 1900; 28333, fragmentary adult, Kasaan Bay, Prince of Wales Is., J. H. Streets; 31877, 1 ♂, Kasaan Bay, Prince of Wales Is., U.S. Bur. Fish Str. *Albatross* Sta. 4243, 42–47 fm; 189481, 1 ♂, Loring, under rock at low tide, L.M.C., 14 April 1903; 28340, 1 ♀, Thorn Arm, SE Alaska, U.S. Fish Comm. Str. *Albatross*, drag seine, 5 July 1897.

Washington.

CAS—2075, 3 ♂, 4 ♀, Friday Harbor, San Juan Is., Puget Sound, Mr. & Mrs. Olroyd, July 1917; 2060, 1 ♂, 2 ♀, Friday Harbor, San Juan Is., Puget Sound; 2102, 1 ♂, Lopez Is., San Juan Is., Olroyd, 1918; 2109, 2 ♂, 1 ♀, San Juan Is., shoreline, Olroyd, 1918; 2117, 1 ♂, San Juan Is., shore; 2105, 1 ♂, Puget Sound, Blanchard, July 1936; 2068, 1 ♂, 1 ♀, Olympia, Thurston County, Puget Sound, just at high tide mark, 17 cm below bottom, J. Nikos, 20 August 1973.



USNM—43315, 2 ♂, Orcas Is., R. L. Moodie; 60081, 2 ♂, 4 ♀, Friday Harbor, B. A. Stevens, 23 July 1926; 63113, 1 ♂, Friday Harbor, Puget Sound, littoral, K. L. Hobbs, 2 July 1928; 155945, 1 ♂, Friday Harbor, San Juan Is., 26 June 1924; 213280, 4 ♂, 1 ♀, Minnesota Reef Spit, San Juan Is., R. L. L., 28 July 1950; 213281, 3 ♂, 1 ♀, Kaneka Bay, San Juan Is., T. Kincaid, 27 June 1904, very poor condition; 155946, 1 ♂, Washington Sound, Lucia Is., Fossil Bay, 15 July 1925; 3074, 2 ♂, Sts. of Fuca, Washington Sound, D. S. Jordan, 1880; 3067, 2 ♂, 1 ♀, Sts. of Fuca, Washington Sound, D. S. Jordan, 1880; 14184, 1 ♂, Port Townsend, J. G. Swan; 213282, 1 ♂, Port Townsend, U.S. Fish Comm. Str. *Albatross*; 15105, 7 ♂, 4 ♀, Port Orchard, Puget Sound; O. B. Johnson, July 1889; 15789, 1 ♀, Puget Sound; specimen figured by Dall (1899) bearing bivalve (*Neaeromya rugifera*); 155948, 1 ♂, Ballard, T. Kincaid, 6 June 1900.

#### Oregon.

AHF—2580-01, 1 ♂, Middle Bay, Cape Arago State Park, Coos Co., 43°18'20"N, 124°19'08"W, intertidal, 1.2 ft tide, rocks, kelp, tidepools, sta. 1468-42, 1 July 1942; 375-03, 1 ♂, old RR spur pier, Yaquina Bay, 44°37'25"N, 124°00'15"W, intertidal, 0.5 ft tide, loose rocks, mud flats, dredge, sta. 1480-42, 15 July 1942; 2579-01, 1 ♂, Oregon coast, Winchester Bay south to Coos Bay, 43°38'45"N, 124°16'10"W, 40 fms, sand, fish, inverts., otter trawler *Rio Janeiro*, dredge, sta. 1465-42, 28 June 1942; 2581-01, 13 ♂, 7 ♀, Coos Bay, South Slough, 1 mi beyond bridge, 43°19'26"N, 124°19'02"W, intertidal, + 0.8 ft tide, hard packed sand and eel grass, empire clam bed dredge, sta. 1496-42, 2 August 1942; 2582-01, 2 ♂, 2 ♀, Coos Bay, ¾ mi above bridge in South Slough, 43°19'33"N, 124°19'10"W, intertidal, 0.1 ft tide, eel grass, mud, empire clams dredge, sta. 1502-42, 15 August 1942.

USNM—105366, 6 ♀ (5 ovig.), Yaquina Bay, 44°38'N, 124°3'W, L. Aldrich, April 1957.

#### California.

AHF—383-02, 1 ♂, Campbell's Cove, Bodega Lagoon near Dillon Beach, Sonoma Co., R. J. Menzies, sta. 1686-49, 26 January 1949; 2585-01, 1 ♂, Campbell's Cove, Bodega Lagoon, vicinity of Dillon Beach, Sonoma Co., R. J. Menzies, sta. 1794-49, 7 February 1949; 2583-01, 1 ♀, Campbell's Cove, Bodega Lagoon near Dillon Beach, Sonoma Co., R. J. Menzies, sta. 1798-49, 11 February 1949; 2584-01, 2 ♀, North Jetty, Bodega Bay, near Dillon Beach, So-

noma Co., R. J. Menzies, sta. 1805-49, 8 March 1949; 2573-01, 3 ♂, 2 ♀ (ovig.), Bodega Bay oyster bed, vicinity of Dillon Beach, Sonoma Co., R. J. Menzies, AHF sta. 1670-49, 14 December 1949; 2214-02, 8 ♂, 3 ♀, 1 juv., Bodega Harbor from jetty to Gaffney's Ranch, Sonoma Co., sand, mud, R. J. Menzies, AHF sta. 1611-48, 8 August 1948; 2574-01, 3 ♂, 2 ♀, Nick's Cove, Tomales Bay, Marin Co., mud, sand, fine sand, rocks, 13–12°C, R. J. Menzies, AHF sta. 1629-48, 3 November 1948; 2575-01, 1 ♂, Elkhorn Slough, Monterey Co., shore, flats, AHF sta. 1590-47, 5 February 1947; 2576-01, 6 ♂, 5 ♀, Morro Bay, San Luis Obispo Co., J. L. Mohr, 6 January 1947, AHF sta. 1582-47.

CAS—2086, 1 ♂, Moss Beach, San Mateo Co., 25 March 1916; 2107, 1 ♀, Half Moon Bay, Quad I 12147244, San Mateo Co., D. Chivers, 27 May 1971; 2103, 1 ♂, Elkhorn Slough, Monterey Bay, J. H. Hill, Watsonville.

ML—Uncat., 1 ♂, Lawson's Flat, Dillon Beach, Tomales Bay, Nybakken, 7–12 July 1971; uncat. 1 ♀, Elkhorn Slough, E side of P.G.&E. outfall, rocky clay area, Nybakken, 4 February 1966; uncat. 1 ♂, Elkhorn Slough Yacht Harbor, mud flats, J. Nybakken, 27 November 1966.

USGS—1 ♂, San Bruno Shoal, San Francisco Bay, Sta. FN29, 13 August 1973.

USNM—105365, 4 ♂, 2 ♀, Bodega Harbor, 38°20'N, 123°4'W, from high-tidal muddy sand near Gaffney Ranch, R. I. Smith, 24 July 1956; 213284, 2 ♀ (1 ovig.), Pierce Pt. on Grays Ranch, extreme NW beach on S shore Tomales Bay, F. B. Tolman, 5 January 1936; 28335, 2 ♀, San Pablo Bay, San Francisco, U.S. Fish Comm. Str. *Albatross*, C. H. Townsend, Chinese shrimp nets, May 1891; 52616, 1 ♂, 1 ♀, Tiburon, San Francisco Bay, 150 ft, U.S. Bur. Fish. Str. *Albatross*, seine, 23 April 1913; 52617, 1 ♀, Sausalito Beach towards Ft. Baker, U.S. Bur. Fish. Str. *Albatross*, 8 February 1918; 14095, 1 ♂, San Francisco Market, L. Stone, January 1876; 89480, 1 ♂ (with *Pseudopythina compressa*), Elkhorn Slough, Monterey Bay, MacGinitie, 12 March 1930; 2530, 1 ♀ (ovig.), Monterey, in *Pholas* hole in rocks, Camfield; 63256, 1 ♂, California, C. F. Winslow, no. 740.

#### West Coast North America.

USNM—14114, 1 ♀ (ovig.); 9312, 1 ♀.

*Diagnosis.*—Ocular spine present. First and/or second abdominal segment usually lacking ventral spines, sometimes with tufts of deciduous spinules in adults; sixth segment without hooked anterolat-

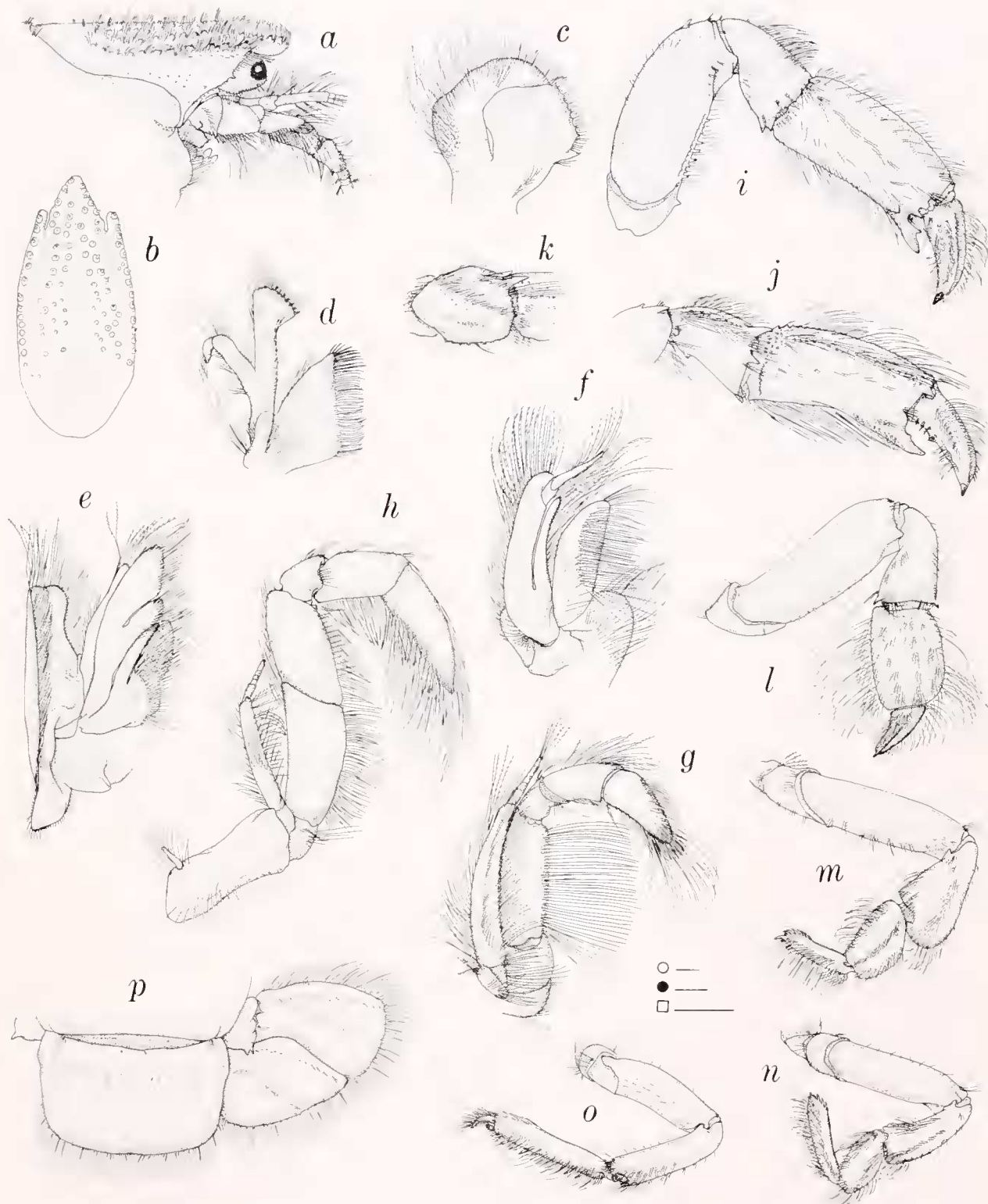


Fig. 13. *Upogebia pugettensis* (Dana). a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, Carpus, dorsal; l, m, n, o, Legs 2-5; p, Telson and right uropods. USNM 28337, ♂, mouthparts from ♀. Scales = 1 mm; ○ = d, e, f, g, h; ● = a, b, i, j, k, l, m, n, o, p; □ = c.

eral spine. Telson essentially rectangular. Antennular peduncle with small distoventral spine on basal article. Cheliped with stout fixed finger  $\leq \frac{1}{2}$  length of dactyl; palm unspined distally at base of dactyl; distomesial margin of carpus with stout spine near middle. Leg 2 lacking proximal mesioventral spine on merus; leg 3 with spineless merus.

*Description.*—(Stevens 1928 and de Man 1929 paraphrased and emended.) Integument, except for dorsal part of carapace, legs, and parts of tail fan, more or less membranous. Carapace about half as long as abdomen, cephalic part flattened and pilose, about twice as long in midline as smooth thoracic part. Rostrum broadly triangular in dorsal view, flanked by shorter frontal process at each side; tip obtuse, reaching almost to middle of second article of antennular peduncle and a little beyond middle article of antennal peduncle; nearly horizontal in lateral view, ventral border may bear short, acute anterior tooth; lateral borders bearing 3–5 conical teeth, short subapical pair well back of tip; 0–2 dorsal teeth near midlength of each side. Lateral rostral teeth  $\frac{1}{4}$ – $\frac{1}{5}$  length of rostrum, behind each a row of 11–12 teeth on ridge lateral to gastric region, surface mesial to this armed with small conical tubercles or teeth, diminishing in size posteriorly. Anterolateral margin with short, acute ocular spine (rarely doubled) near eye. Extension of epistome in lateral view bearing 1–3, usually 2, tiny distal spines near dorsal margin. Shoulder lateral to cervical groove armed with about 20 microscopic sharp teeth, dorsalmost largest. Thalassinidean line continuing to posterior margin of carapace.

Abdomen rather broad; first and/or second segment usually lacking ventral spines, sometimes tufts of deciduous spinules in adults; sixth segment 1.5 times as broad as long, its lateral border bearing angled lobe behind middle, upper surface with lunate groove at either side anteriorly.

Telson about 1.5 times broader than long, widest in anterior  $\frac{1}{5}$ , sides thereafter slightly convergent; upper surface with low, smooth, slightly curved carina on each side uniting in transverse crest from which median furrow runs to posterior margin; area lateral to furrow finely punctate.

Eyestalk short, slightly exceeding lateral rostral process; cornea narrower than basal part of stalk, directed anterolaterally.

Antennule with middle article of peduncle about  $\frac{1}{4}$  length of first and third articles, first article broad proximally but narrowing by half distally, small sharp tooth at distoventral end of inner border; flagella subequal; lower thinner flagellum longer, its seg-

ments longer than broad; upper flagellum composed of segments as broad as or a little broader than long.

Antenna with flagellum longer than carapace; second article with small distoventral spine; scale small, oval.

Third maxilliped extending almost to middle of rostrum if held alongside it, exopodite reaching to distal end of merus. Other mouthparts as figured; maxilliped 3 bearing epipod.

Chelipeds equal. Ischium with small spine on lower border. Merus a little more than twice as long as broad, lateral surface broad; upper border curved, bearing small spine mesially at  $\frac{1}{5}$  length from carpal end (sometimes unarmed); ventrolateral border fringed with setae and armed with 5–6 sharp microscopic denticles; ventromesial border bearing 4 much larger acute spines increasing in size posteriorly; row of long, silky setae mesial to these spines. Carpus with shallow longitudinal furrow in middle of lateral surface; oblique row of setae on dorsal surface running from proximal extremity of mesial border to middle of distal border; strong spine at distal extremity of mesiodistal border preceded by 4–10 or more very small teeth, lateral to large spine another much smaller spine on distal margin; distomesial margin bearing large spine at middle; still another spine at distoventral corner and between it and chela a small acute prominence.

Palm less than twice as long as deep, slightly convex longitudinally, somewhat more so transversely; lateral surface with oblique densely setose line below and line of distant short setae above middle; dorsolateral surface bearing ridge finely denticulate except in midlength; mesial to this a row of microscopic teeth, both ridge and row fringed with long setae; mesial surface with transverse, slightly curved row of acute tubercles or granules on proximal border near carpal articulation; mesiodistal sharp spine at base of dactyl; ventral margin rounded, fringed with setae, tuft implanted near distal margin and articulation of dactyl. Fixed finger about half length of dactyl, directed ventromesially; prehensile surface with 1 conical tooth near middle. Dactyl nearly  $\frac{3}{4}$  length of palm, slightly curved; both lateral and mesial borders of upper surface ridged, imparting furrowed appearance, mesial ridge bearing row of 6 corneous tubercles in proximal half, lateral ridge smooth, each ridge flanked mesially by fringe of setae; lateral surface bearing row of up to 6 or 7 rather obtuse tubercles fringed with setae, 2 or 3 smaller tubercles near them; prehensile surface concave mesially and armed laterally with tooth at  $\frac{1}{4}$  and  $\frac{1}{2}$  length from proximal end.



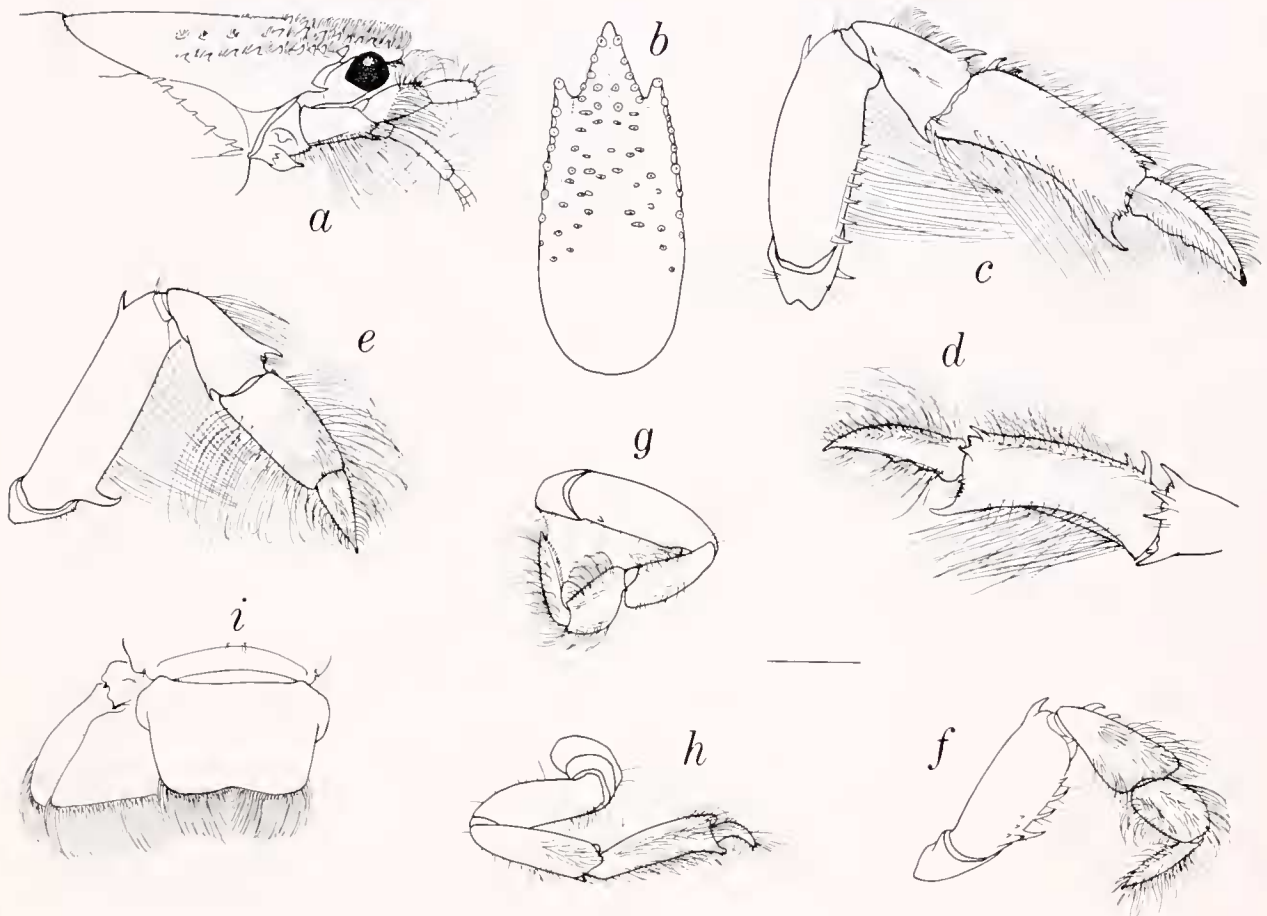


Fig. 14. *Upogebia schmitti* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2–5; i, Telson and left uropods. AHF 3933, ♀ Holotype. Scale = 1 mm, all figures.

Leg 2 with fringe of long, silky setae on lower inner margin of merus, lower margin of propodus, and shorter denser setae on upper and outer distal surface of propodus and dactyl; carpus with small distal spine on upper margin and slightly larger one on lower distal margin; merus usually with tiny sub-distal spine on superior margin.

Remaining legs spineless except for disto-dorsal and -ventral angles on carpus of leg 1 and poorly developed distal spines on fixed finger of subchela on leg 5; dactyls setose and with file of short, close-set spinules along lower margin; propodi and distal parts of carpi setose; ventrolateral aspect of merus on leg 3 sparsely and stiffly setose.

First pleopods of female slender, biarticulate, terminal article slightly shorter than basal article.

Two arthrobranchs arranged in biserial row of undivided (entire) narrow lamellae on maxilliped 3 and legs 1–4.

Uropods slightly exceeding telson, exopod round-

ed distally and longer than triangular endopod with nearly straight distal margin; exopod with 2 curved longitudinally parallel ribs in lateral half, inner with single rib; both rami with lateral marginal ribs as well, that of exopod evenly convex laterally, that of endopod slightly concave laterally but angling and changing to convex proximally; both with minute marginal spines distally and dense fringe of setae; protopodite bearing small spine (occasionally doubled) lateral to articulation of endopod.

*Measurements (mm).*—Total length 75–100 (MacGinitie 1930); to 112 (Johnson and Snook 1927); males smaller than females (MacGinitie and MacGinitie 1949).

*Color.*—Younger specimens vineaceous-buff, densely mottled with deep olive to king's blue above, mottling in older specimens deep olive. In specimens kept in a live box for a few days, deep olive entirely replaced by king's blue which may appear even on chelipeds and walking legs (essentially quot-

ed from Stevens 1928); dirty bluish white (Ricketts and Calvin 1968).

*Habitat*.—Burrowing in muddy beaches, mud flats, slough bottoms or mud bottoms of estuaries, more abundant where soil contains considerable clay, intertidal to several fathoms in nearshore waters (several authors, see synonymy and remarks).

*Type-locality*.—Puget's Sound.

*Known range*.—Sawmill Bay new Valdez, Alaska, to Morro Bay, California. The distribution repeated by many authors as southeastern Alaska to Bahía de San Quintín, Baja California Norte, is here restricted, a form occurring south of Point Concepcion, California, being recognized herein as *U. macginitieorum* new species.

*Remarks*.—The natural history of *U. pugettensis* has been more thoroughly studied than that of any other species of *Upogebia* in the eastern Pacific (Johnson and Snook 1927; Stevens 1928, 1929; MacGinitie 1930; MacGinitie and MacGinitie 1949; Smith et al. 1954; Ricketts and Calvin 1968; L. C. Thompson and Pritchard 1969; R. K. Thompson and Pritchard 1969; R. K. Thompson 1972; Powell 1974; Pritchard and Eddy 1979).

Ovigerous females are known in various part of the range from December to early summer (Stevens 1928; Hart 1937). Hart described three larval stages and a postlarva from Departure Bay, British Columbia.

#### *Upogebia schmitti* new species

Figure 14

*Material examined*.—Panama.

AHF—2541-01 (Holotype 3933) ♀ (ovig.), Bahia Honda, shore, *Velero III* sta. 947-39, 28 March 1939.

*Diagnosis*.—Postocular spine present. Rostrum with extremity exceeding that of eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with fixed finger much shorter than dactyl; palm spineless mesially proximal to base of fixed finger; ischium with 1 spine on ventral margin. Leg 2 with proximal mesioventral spine on merus; merus of leg 4 with ventral spines.

*Description*.—Rostrum broadly triangular, straight; tip exceeding pair of moderate, subapical dorsal spines situated more or less side by side and followed on each side by 4 spines of about equal size; ventral margin bearing small terminal and subterminal spine; central dorsal rostral surface bearing tufts of setae but spineless, merging with pilose field of spiniform tubercles and tubercles diminishing over approximately  $\frac{2}{3}$  of anterodorsal carapace and an-

gling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 10–11 spines of nearly uniform size becoming more obliquely angled in posterior part of row. Cervical groove deep and continuous, rather sharp shoulder lateral to it bearing 7 spines below level crossed by thalassinidean line, latter continuing to posterior margin of carapace. Postocular margin bearing acute spine.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae in tracts on pleura of segments 3–5 and tuft on posterolateral corner of 2; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, sides slightly convergent posteriorly, distal margin shallowly biarcuate and densely fringed with setae; transverse anterior ridge strong, continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk reaching to level of subapical dorsal spines on rostral margin; more or less angled upward, good sized terminal cornea directed laterally.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 lacking subdistal ventral spine; scale moderate.

Mouthparts as figured for *U. jonesi*; maxilliped 3 bearing epipod.

Epistomial projection broad in lateral view, bearing single strong spine.

Chelipeds essentially equal, rather slender. Coxa drawn into hooked ventral spine. Ventral margin of ischium bearing 1 strong spine. Merus with 7 (right) and 6 (left) spines on ventral margin; subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, a shallow longitudinal groove laterally, lacking spine at distal ventrolateral corner; reduced mesiodorsal crest of forwardly directed spines (1 right, 2 left) behind and rather remote from prominent spine on distal margin; latter flanked by remote cluster of 2–3 tiny spines on distodorsal margin and followed below on distomesial margin by 2 rather strong spines, ventral one largest; distoventral spine strong. Palm oval in cross section, length including fixed finger about 3.7 times maximal height;

prominent setae in 4 dorsal rows, longer in ventral tract, some setae along low lateral ridge, and tufts distally; dorsal crests low; right palm with 2, left with 1 spine proximally, and each with distal spine at base of dactyl; lateral condyle of dactyl with small spine below it, mesial condyle with spine and another smaller spine below that near base of fixed finger; mesioproximal surface bearing very low granular ridge. Fixed finger about  $\frac{1}{4}$  length of dactyl, slender and gently curved in lateral view distally but broadly joined to palm, about 3 teeth on proximal part of prehensile edge. Dactyl slightly curved, setose, much stouter than fixed finger, and tapered to corneous slender tip; prehensile edge with single large tooth at about midlength, portion proximal to it sinuous.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus bearing subdistal dorsal and ventral spine; elongate merus with slender subdistal dorsal and strong proximal mesioventral spine. Leg 3 with slender pointed dactyl extending beyond rostrum; carpus with 2 spines proximally on dorsal margin; merus with 3 spines on ventral margin and cluster of obsolescent spines proximovertrally. Leg 4 with proximal ventral spine on merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae distally; endopod with rather prominent median longitudinal rib and lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing tubercle or obsolescent spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype ovigerous female, length anterior carapace 4.4, length carapace 6.4, length chela including fixed finger 2.8, height chela 0.8.

*Remarks.*—*Upogebia schmitti* is one of a number of species in the east Pacific that have a strong proximal mesioventral spine on the merus of the second leg. It resembles *U. spinigera* in possession of ventral spines on the merus of the fourth leg, but differs from that species in having a much shorter fixed finger on the chelae and in possession of strong spines on the shoulder flanking the cervical groove. No other east Pacific species shows such well-developed spines on this feature.

*Name.*—The name is in honor of Dr. Waldo L.

Schmitt who collected many of the decapod crustaceans deposited in the Allan Hancock Foundation and had a special interest in the thalassinideans.

*Upogebia spinigera* (Smith)

Figure 15

*Gebia spinigera* Smith 1871:92.—Lockington 1878:300.—Pocock 1890:515.

*Upogebia (Upogebia) spinigera.*—Borradaile 1903:543.—De Man 1928:23, 39, 45.

*Upogebia (Upogebia) sturgisae* Boone 1931:161, fig. 11.

*Upogebia spinigera.*—Holthuis 1952:3 (part), figs. 1–2.

*Upogebia rostrispinosa* Bott 1955:49, pl. 3, figs. 3a–b (part: the holotype female).—Thistle 1973:2–23 (passim), fig. 6.

*Material examined.*—El Salvador.

NMS—2116 (Holotype of *U. rostrispinosa* Bott) 1 ♀, Puerto El Triunfo, Peters.

Nicaragua.

USNM—77427 (Syntypes) 5 ♂, 5 ♀, frags., West coast of Nicaragua, J. A. McNiel (donor), Kingsley collection #374.

Costa Rica.

AHF—1921-2, 1 ♂, 2 ♀, 1 juv., N shore of Punta Morales, Golfo de Nicoya, R. C. Brusca, 21 February 1980.

NMS—0927/5, 1 ♂, 1 ♀ (ovig.), incomplete specimens.

USNM—64115, 2 ♀, Isla San Lucas [Golfo de Nicoya], M. Valerio, 15 January 1930.

Panama.

USNM—142730, 1 ♀, Bahía Parita, 8°13.2'N, 80°29.1'W, Aguadulce tidal flats, Golfo de Panama, intertidal, M. L. Jones et al. 24 April 1971; 213286, 1 ♀, 1 juv., ♀ (5 juv. near *U. spinigera*), Aguadulce on Bahía Parita, 8°13.2'N, 80°29.1'W, tidal flats E of town and S of Estero Aguadulce, sandy mud, large rock outcrops, 0–2 ft, low tide, M. L. Jones et al., 20–6, 24 April 1971, hand net, poison, sieve (♀ is spineless); 213287 1 ♀, Venado Beach about  $\frac{3}{4}$  way to Venado Is., tide pools and streams to either side of connecting sandbar, 0–2 ft, C. E. Dawson, 1529, 19 March 1972, ichthyocide; 213288, 2 ♀, Ft. Kobbe Beach, approx. 8°53'45"N, 79°34'45"W, tidepools, rock, sand, broken shell, to 3 ft, C. E. Dawson, 1317, 27 July 1968, Chem-fish; 213289, 4 ♀ (1 ovig.), 6



juv., Ft. Kobbe Beach toward Veracruz, L. G. Abele, 69-49, 8 May 1969; 213290, 1 ♀, Fort Kobbe beach off SW end, rock, sand, mud, offshore, tidepools among sparse mangrove inshore, 0-0.75 m, 25°C, 30‰, C. E. Dawson and party, 1587, 3 November 1972, ichthyocide; 213291, 2 ♀, 19 juv., Farfan Point, 8°56'N, 79°34'W, sand, mud, rock tidepool 0-6 ft, 30.5°C, 26‰, C. E. Dawson and party, 1506, 5 November 1971, ichthyocide (1 has 3 internal spines on carpus); 213292, 3 ♀, Farfan Point, 8°56'N, 79°34'W, 0-0.75 m, ebb-flood tide, sand, sandy mud, rock, 31°C, 27.8‰, C. E. Dawson and party, 1591, 7 November 1972, ichthyocide; 213293, 1 ♀, Farfan Point, 8°56'N, 79°34'W, tidepools, mainly sand, some rock and silt, ebb-flood tide, 35°C, 33‰, 0-1 m, C. E. Dawson and party, 1609, 6 April 1973, ichthyocide (taken with *U. longipollex*); 213294, 1 ♀, Farfan Beach, tide pools, 27.6°C, 32‰, Newman et al., 134-1-d, 6 April 1973; 213295, 2 ♂, 1 ♀, Farfan Point, 8°56'N, 79°34'W, 0-1.3 m, sand, mud, rocks, low flood, 30°C, 24‰, C. E. Dawson and M. L. Jones, 1663, 12 November 1973, ichthyocide; 213296, 1 ♀, 1 frag., Farfan Point, 8°56'N, 79°34'W, 0-2 ft, sand, mud, rocks, C. E. Dawson, 1724, 11 February 1975, ichthyocide; 213297, 1 ♀, Farfan Point, 8°56'N, 79°34'W, sand, mud, rocks, 0-2.0, 25°C, C. E. Dawson, 1739, 4 February 1977, ichthyocide; 213298, 2 ♀ frags., Fort Amador, Naos Is., 8°55'15"N, 79°32.25'W, mud-sand beach, rocky intertidal, M. L. Jones, 46-1, 29 April 1971; 213299, 1 ♀, NE end of causeway to Naos Is., 8°56'07"N, 79°32'47"W, 0-3 in, sand, pebbles, tide rills, 29.5‰, Dawson and Dawson, 1483, 30 June 1971, Nox-fish (has 3 inner spines on carpus, p4 missing); 213300, 1 ♀, Naos Is., beach between pilot float and bunker lab, rocks at S side, 29°C, 35‰, M. L. Jones and D. Pawson, 49a, 2 November 1971; 213301, 17 ♀, NE end of causeway to Naos Is., 8°56'07"N, 79°32'47"W, small rocks, coarse sand, gravel, low flood tide, 0-4 in, C. E. Dawson, 1502, 2 November 1971, ichthyocide (16 typical *U. spinigera*, 1 ♀ with carpus asymmetrical—3 spines on 1 side—2 on other, there are 6 other small females with no spines on merus of p4, and 3 inner spines on carpus—one has ventral spines on abd. (= *U. longipollex*?); 213302, 4 ♀, E end Naos Is., 8°56'07"N, 79°32'47"W, small rocks, silt-gravel, tide pool at low tide, 29.5°C, 28‰, C. E. Dawson, 1521, 15 January 1972, ichthyocide; 213303, 2 ♀, 1 juv., Naos Is., rockpile on E side of causeway 0-3 ft, rocks, silty sand to gravel, low tide, C. E. Dawson, 1522, 15 January 1972, ichthyocide (taken from large lot of *U. longipollex*, have 2 internal sp. on carpus and spines on merus

of p4); 213304, 11 ♀, NE end of causeway to Naos Is., 8°56'07"N, 79°32'47"W, 0-2 in, rocks, silt, sand-gravel, low flood tide in tidepools, C. E. Dawson, 1527, 18 March 1972, ichthyocide (taken with *U. longipollex*); 213305, 2 ♀, NE end of causeway to Naos Is., 8°56'07"N, 79°32'47"W, 0-6 cm, gravel and sand, low tide, 24.5°C, 33.5‰, C. E. Dawson, 1531, 12 April 1972, ichthyocide (1 has 2, other 3 internal spines on carpus, no spines on merus of p4); 213306, 1 ♂, 2 ♀, NE end Naos Is., 8°56'07"N, 79°32'47"W, gravel and sand, ebb-low tide, 0-6 cm, 32°C, 27‰, C. E. Dawson and party, 1604, 3 April 1973, ichthyocide; 213307, 2 ♀, San Francisco Beach near Panama City (tide pools), S. F. Hildebrand, 13 February 1937 (not typical and fragmentary, specimen lacking p4 has 3 mesial spines on carpus of chela; specimen lacking chelae has no spines on merus of p4; both have spines on ridge lateral to cervical groove); 213308, 2 ♀ + 1 chela, Panama Reef off French Fort, 8°57'N, 79°31'40"W, rock, sandy silt and gravel, tide pools, low tide, 33.2°C, 30‰, 0-3 ft, Dawson, Dawson and McCosker, 1498, 9 July 1971, Chem-fish; 213309, 1 ♀, Panama Reef off French Fort, 8°56'40"N, 79°31'45"W, rock, sand, shell and pebbles, low tide, 0-2 ft, 33°C, 30‰, Dawson, Dawson and McCosker, 1499, 10 July 1971, Chem-fish (with *U. longipollex*); 213310, 6 ♀, many small ♀ and juvs., (some have 3 internal spines on carpus but spines on merus of p4), Panama Reef off French Fort, 8°56'45"N, 79°31'45"W, rock tide pools, silt and gravel, low tide 0-2 ft, 32°C, 25‰, C. E. Dawson and party, 1507, 6 November 1971, ichthyocide (1 *U. longipollex* with this coll.); 213311, 2 ♂, Panama Reef off French Fort, 8°56'45"N, 79°31'45"W, 0-1 m, tidepools, ebb-flood, rock, sand, gravel 28°C, 34‰, C. E. Dawson and party, 1538, 18 April 1972, ichthyocide (with *U. longipollex*); 213312, 1 ♀, Panama Reef off French Fort, 8°56'45"N, 79°31'45"W, rock, sand and gravel, pools and channels, ebb-flood tide, 0-1 m, 30.2°C, 33‰, C. E. Dawson and party, 1608, 5 April 1973, ichthyocide; 213313, 1 ♂, 1 ♀, Whorehouse Reef, Panama City, under rocks, tide pools, 30.2°C, 33‰, Newman et al., 133-5-6, 5 April 1973; 213314, 1 ♀(?), Whorehouse Reef, Panama City, sand/mud, 1 m, 30°C, 22‰, M. L. Jones, 263-2, 20 July 1978, seive at low tide (has 3 internal carpal spines but obsolescent spines on merus of p4); 213315, 1 ♂, 39 ♀ (7 ovig.); Bella Vista, out of log; 7 February 1941 (taken with several mature *U. longipollex*); 213316, 2 ♀, Punta Paitilla, E side, rock channels and tidepools, 0-1.3 m, 34°C, 27‰, C. E. Dawson and party, 1602, 1 April 1973, ichthyocide (taken with *U. longipollex*);

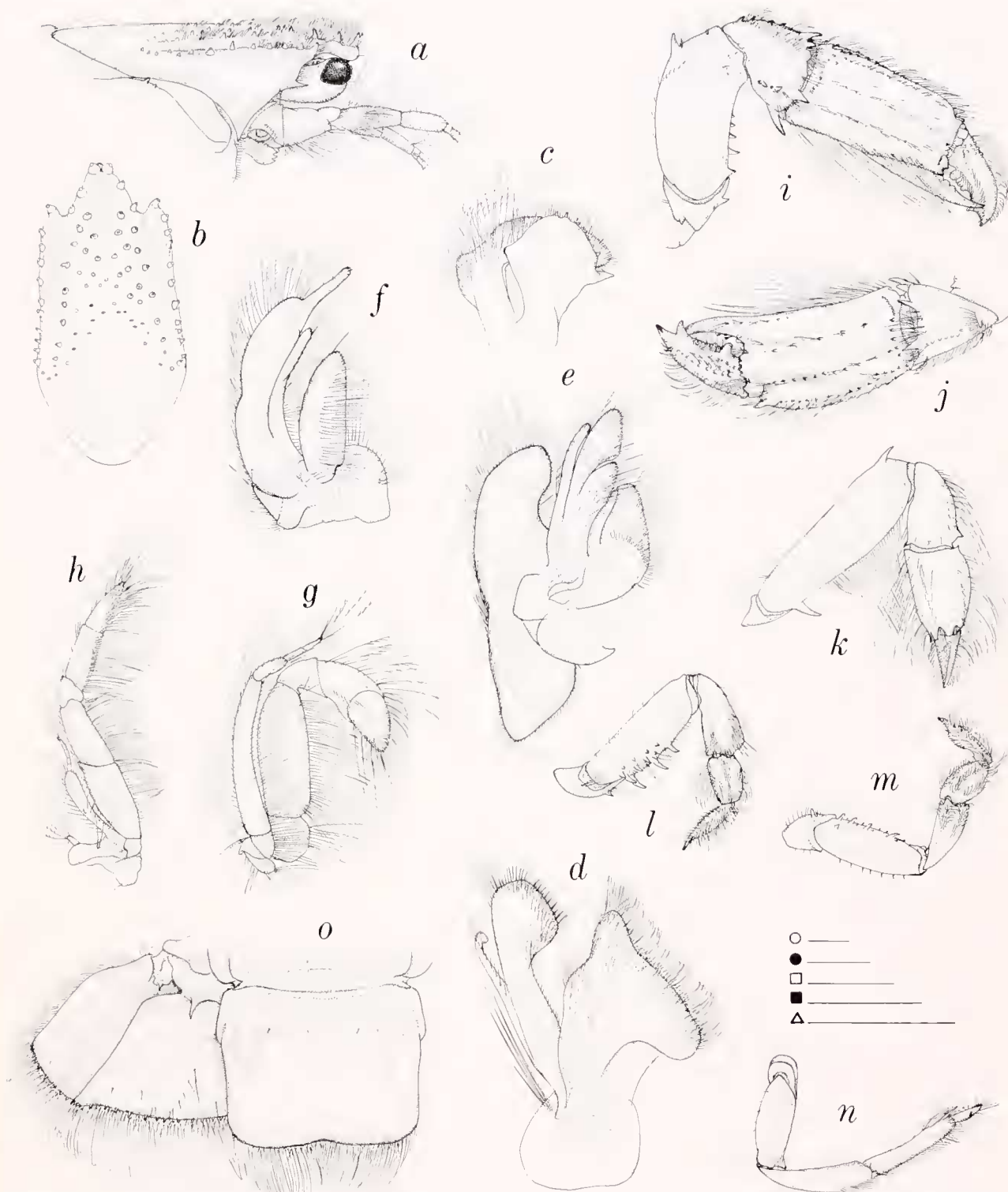


Fig. 15. *Upogebia spinigera* (Smith). a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped, i, lateral, j, mesial; k, l, m, n, Legs 2-5; o, Telson and left uropods. USNM 77427, ♂ Syntype; mouthparts from frag. Scales = 1 mm; ○ = a, b, h, i, j, k, l, m, n, o; ● = f, g; □ = e; ■ = d; △ = c.

213317, 3 ♀ (1 ovig.), Bella Vista, Rocky Point, 15 February 1941; 213318, 2 ♀, Salinas Bay, shore, beach beyond reef, sand, stone, W. L. Schmitt, AHF 474-35, 10 February 1935; 213319, 3 ♀, shore of Panama, low tide rocks, E. Deichmann, May–July 1924.

Ecuador.

USNM—213320, 1 ♀, Puerto de El Morro, mangrove swamp, A. Vincent, 1 June 1975.

*Diagnosis.*—Postocular spine present. First and/or second abdominal segment bearing ventral spines; sixth segment lacking hooked anterolateral spine. Telson essentially rectangular. Leg 2 with strong proximal mesioventral spine on merus; merus of leg 4 with ventral and/or ventrolateral spines.

*Description.*—Rostrum triangular, short, straight or slightly downturned; tip usually slightly exceeding eyestalks and sometimes bearing small ventral spine(s); dorsal pair of strong subapical spines followed on each side by 2 spines successively shorter in length; dorsal  $\frac{2}{3}$  of carapace anterior to cervical groove bearing pilose tufts, its surface spiny anteriorly to tuberculate and angling toward sides posteriorly; gastric  $\frac{1}{3}$  posterior to this smooth; ornamented anterior part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 11 to 13 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, shoulder lateral to it bearing about 3 small tubercles below intersection with thalassinidean line; latter continuing to posterior margin of carapace. Postocular spine present.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins on segments 1–2 variably bearing deciduous spinules; with dense fine plumose setae on posterior margin of terga 3–4 and in tracts on pleura of segments 2–5; sternites 1–2 sometimes bearing very short spines; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long but broadest proximally, angle on anterolateral margin interlocking with groove on central rib of uropodal endopod; distal margin slightly concave and densely fringed with setae; transverse proximal ridge fairly prominent and continuous with low lateral ridges at each side; median groove obsolescent.

Eyestalk stout, deepest at about midlength, convex and setose ventrally; cornea narrower than diameter of stalk and directed anterolaterally.

Antennular peduncle reaching to about proximal  $\frac{1}{4}$  of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus somewhat longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval, sometimes with minute terminal spine.

Mouthparts as figured for *U. jonesi*; maxilliped 3 with epipod.

Epistomial projection rather broad in lateral view, bearing 2 or more unequal spines at anterolateral angle.

Chelipeds essentially equal. Ventral margin of ischium bearing 1 small spine. Merus with single subdistal dorsal spine reaching level of postocular spine, row of 3–5 small to moderate spines on proximal  $\frac{1}{2}$ – $\frac{2}{3}$  of ventral margin. Carpus trigonal, a shallow longitudinal groove laterally and strong spine (usually) at anterior ventrolateral corner preceded or flanked by 1 or more smaller spines tending to form row and diminishing in size proximally; mesiodorsal crest of almost uniform small spines, partly obscured by setae in proximal part of row, behind prominent spine on anterior margin, all directed forward; comb of about 4 spines lateral to this on anterior margin and 2 spines below it on distomesial margin, ventral one largest, smaller intermediate spine often obsolescent or absent; distoventral spine slender but strong. Palm oval in cross section, length including fixed finger about 2.1–2.9 times maximal height; bearing mixed prominent plumose and long setae in 3 dorsal rows plus a row of long setae dorsomesially; 2 dorsal crests of spiniform tubercles flanked by similar but somewhat less prominent dorsomesial row of same in line with small acute spine below mesial condyle of dactyl, variable number of tiny spines below it on anterior margin of palm; proximomesial surface of palm bearing sinuous granular vertical ridge; lateral condyle of dactyl with small but stout spine below it. Fixed finger about  $\frac{3}{4}$  length of dactyl, depending on wear, slightly curved and tapering to slender tip reaching level of strong subdistal dactylar tooth, 4 or 5 small teeth on proximal prehensile edge. Dactyl much stouter than fixed finger, its curved upper surface bearing about 3–6 small proximal, spiniform tubercles; curved, rather acute corneous tip preceded by strong



calcareous tooth on prehensile edge, and that in turn by a more or less straight raised edge capped by row of about 8 or 9 close-set small teeth, growing larger and more widely spaced proximally, and then a toothless proximal notch.

Leg 2 reaching about to distal  $\frac{1}{4}$  of palm; carpus with tiny distodorsal spine and stronger, acute, subdistal ventral spine; merus with strong mesioventral, proximal spine; coxa with strong proximal and smaller distal spine mesially. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with row of strong ventral spines and often a cluster of smaller ventrolateral spines; ischium often bearing distoventral spine. Leg 4 with row of spines on or near ventral margin of merus, almost always prominent but sometimes reduced to obsolescence and barely evident at proximal end, especially in juveniles; ischium often bearing distoventral spine. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with acute spine on protopod overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute scattered spines or granules on distal margin and dense fringe of setae; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial sturdiest one bearing strong, acute spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Male, length anterior carapace 6.4, length carapace 9.5, length chela including fixed finger 5.6, height chela 2.6. Syntype ovigerous female, same, 7.0, 10.2, 6.1, 2.1.

*Type-localities.*—Isla de Aserradores, 20 mi (32.18 km) northwest of Corinto, Nicaragua, and Golfo de Fonseca.

*Known range.*—Golfo de Fonseca to Ecuador.

*Remarks.*—Holthuis (1952) gave an exhaustive description of *U. spinigera* based upon a sample of one male and one female, both about 40 mm total length, from Buenaventura, Colombia. The size of those specimens is slightly larger than that of specimens for which measurements are given above. Holthuis had no specimens of *U. longipollex* with which to compare his material and he therefore followed others in suggesting that these two species are probably synonymous. He did, however, synony-

mize Boone's *U. sturgisae* with *U. spinigera*, in which I concur. Abundant material now available from Central America permits a meaningful comparison of *U. spinigera* with *U. longipollex*, and their distinctions are discussed in the account for *U. longipollex*. Bott's *U. rostrospinosa* falls within the range of variation shown by *U. spinigera*.

Aside from the differences pointed out above, it is noteworthy that *U. spinigera* does not reach as large a size as *U. longipollex*. Females predominate in the samples; moreover, large specimens of the former species are almost invariably females whereas large males are not infrequent among the latter. Ischial spines on legs 3 and 4, usually not present in juveniles, become more evident with age.

### *Upogebia tenuipollex* new species

Figure 16

*Material examined.*—Ecuador.

AHF—2601-08 (Paratypes 6814) 6 ♂, Isla de Santa Clara, Golfo de Guayaquil, 3°10'13"S, 80°26'10"W, dug from soft sandstone full of holes, E. Ball, *Te Vega XVIII-1*, 6 April 1968.

USNM—213236 (Holotype) ♂, Bahía de Caráquez, rocks, in burrows of boring clams, A. McCrary, 22 June 1975; 213237 (Paratypes) ♀, same; 213238 (Paratype) 2 ♂, 1 intersex? same; 213239, 1 ♂, Manta, shore 1 mi (1.6 km) S, reef with breakers, AHF 403-35, 20 January 1935.

Probably *U. tenuipollex* but too small to be determined with certainty; 21628, 1 juv., off Cabo de San Francisco, 0°39'30"N, 80°06'30"W, 2 fm, mud, rock, *Velero III* 214-34, 11 February 1934; 216281, 1 juv. ♀, same, 0°37'10"N, 80°00'30"W, 15 fm, mud, rock, *Velero III* 850-38, 23 February 1938.

*Diagnosis.*—Postocular spine absent. First and second abdominal segments lacking ventral spines; sixth segment lacking hooked anterolateral spine. Telson essentially rectangular. Cheliped with subdistal spine on strongly curved dorsal surface of merus; fingers long, fixed finger (when not broken) as long as dactyl. Merus of leg 2 with tiny subdistal dorsal spine but lacking proximal mesioventral spine; leg 3 with cluster of spines and tubercles ventrolaterally on merus.

*Description.*—Rostrum broadly triangular, exceeding distal edge of eyes, almost straight or slightly curved downward, dorsally bearing 2 strong subapical, slightly backward curved teeth followed after an interval by 2 similar, somewhat smaller teeth on margin; dorsal  $\frac{2}{3}$  of carapace anterior to cervical

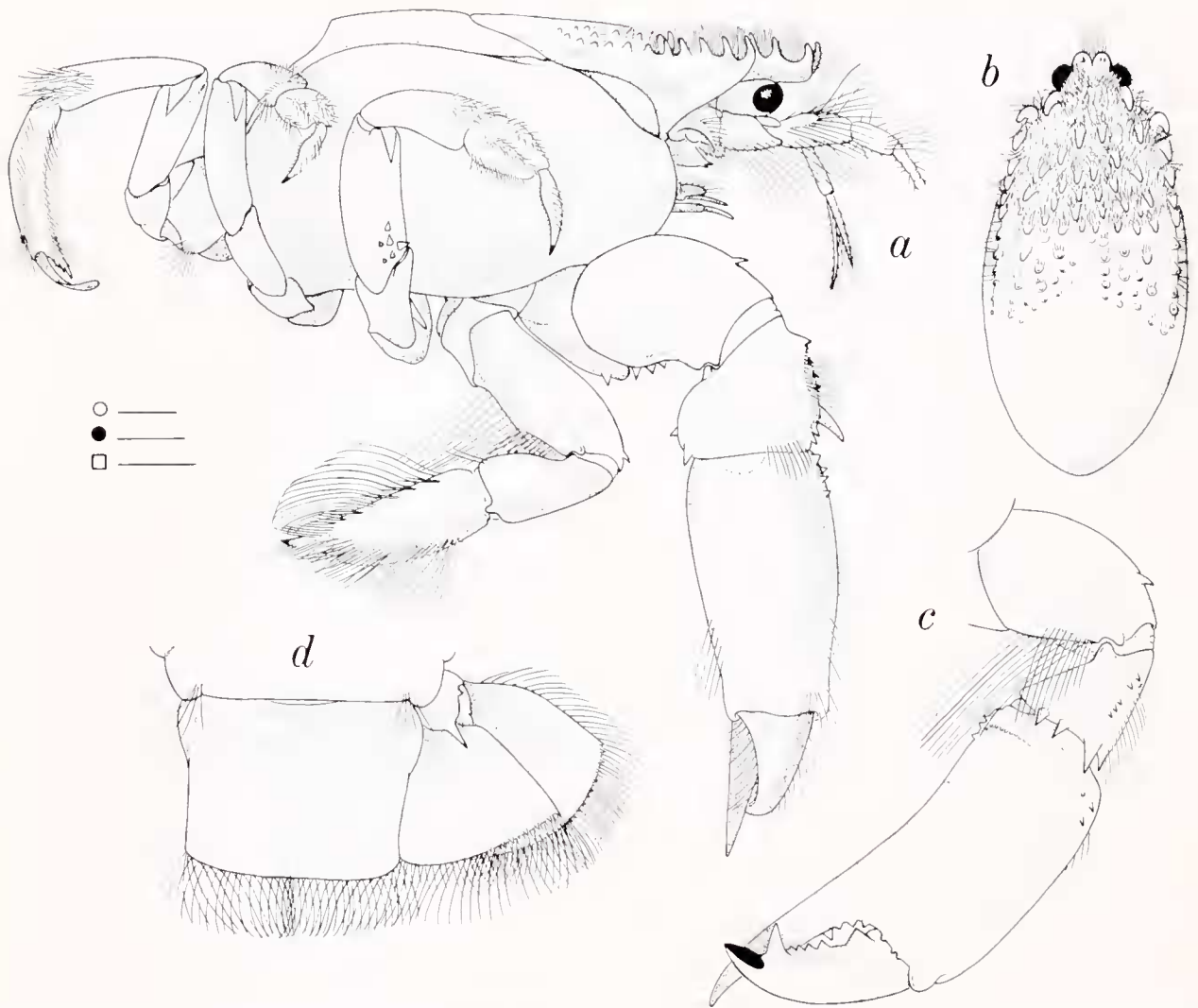


Fig. 16. *Upogebia tenuipollex* new species. a, Cephalothorax and legs, lateral; b, Anterior carapace, dorsal; c, Cheliped, mesial; d, Telson and right uropods. USNM 213236, ♂ Holotype. Scales = 1 mm; ○ = a, c; ● = d; □ = b.

groove bearing pilose tufts and armed with tract of spiniform teeth diminishing to tubercles and obsolescence as it angles toward sides posteriorly; gastric  $\frac{1}{3}$  posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of 9–11 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly. Cervical groove deep and uninterrupted; thalassinidean line continuing to posterior margin of carapace. Postocular spine absent.

Abdomen smoothly arched dorsally, dense transverse bands of plumose setae at posterior margin of terga on segments 2–4 and along pleura of segments 3 and 4; pleura of segment 1 narrowly rounded pos-

terolaterally, those of segments 2–5 broadly rounded; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long, slightly narrowed distally, distal margin obscurely biarcuate and fringed with dense plumose setae; rather sharp transverse, anterior ridge curving into short rib parallel to margin at each side, median groove obsolescent.

Eyestalk not reaching level of subapical rostral spines, cornea large but not dilated, directed anterolaterally.

Antennular peduncle reaching about to proximal

¼ of terminal article of antennal peduncle, proximal 2 articles together slightly longer than terminal article; flagella unequal, lower thinner ramus extending about half its length beyond terminal peduncular article of antenna.

Antennal peduncle with evenly rounded scale reaching about level of distal edge of cornea; basal article bearing low subdistal ventral spine; flagellum longer than carapace, moderately setose.

Mouthparts as figured for *U. macginitieorum*; maxilliped 3 bearing epipod.

Epistomial projection bearing 2 small spines at tip in lateral view.

Chelipeds essentially equal, stout, inflated except for elongate fingers. Ischium with single small spine on ventral margin. Merus with 1–3 small spines or tubercles on straight ventromesial margin; small, forwardly directed subdistal spine on strongly curved superior margin, spine reaching about level of cornea. Robust carpus roughly quadrilateral in lateral view, a shallow groove on dorsolateral surface; posteroventral angle rounded; small distoventral spine laterally; mesiodorsal crest of small spines or tubercles ending distally in strong spine directed forward, flanked laterally on distal edge by 3 close-set unequal small spines and followed below by 2 larger but more widely spaced spines on mesial border; small acute buttressed spine mesioventrally. Palm with slightly transverse crest of obsolescent tubercles near articulation of carpus laterally, longer more prominent row of small beaded granules proximomesially, curving short distance forward on ventral margin; obsolescent longitudinal row of granules on dorsal side proximally and row of widely spaced granules mesially; small blunt spine laterally on distal margin of palm below articular condyle of dactyl and comparable obsolete tooth or teeth mesially; prominent fixed finger as long as dactyl but more slender, drawn to subacute tip gently curved toward dactyl and deflected slightly laterad, 3 or 4 closely spaced, short conical teeth on proximal cutting edge. Dactyl stout, closing inside fixed finger; broad basally but tapering to slender, subacute, corneous tip; longitudinally ridged laterally; glabrous dorsolateral tract with 2 short rows of obsolescent tubercles at its base, rows of setae along other surfaces; cutting edge armed with subdistal acute tooth followed by row of about 5 uneven, sharply conical small teeth ending in larger remote, bluntly conical tooth near proximal smooth space.

Leg 2 reaching about to midlength of palm; merus with subdistal spine on superior margin; carpus spineless except for distodorsal protuberance. Leg 3

with few ventrolateral spines on merus proximally. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with strong, acute spine overhanging central rib of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae on distal margin; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing small tooth or granule on shoulder proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Male holotype, length anterior carapace 5.8, length carapace 7.9, length chela including fixed finger 7.4, height chela 2.5. Paratype female, same, 5.9, 8.1, 4.9 (palm only, finger broken), 2.3.

*Known range.*—Ecuador.

*Remarks.*—*Upogebia tenuipollex* belongs to that group of Atlantic and Pacific species of *Upogebia* that lack a mesioventral proximal spine on the merus of the second leg, but it differs from other group members in lacking a postocular spine. It seems closest to *U. burkenroadi* in possession of long, relatively slender fingers on the chelipeds, but has a much stronger and differently shaped carpus, and has stronger spines on the merus of the third leg. Among the group of species having a proximal mesioventral spine on the merus of the second leg, it has fingers on the cheliped most closely resembling those of *U. longipollex*.

The holotype alone, among specimens examined, has the fixed finger of both chelae intact. In all the others this member is incomplete, suggesting that its thinness makes it weak and easily broken, especially during the stress of being captured or preserved.

*Name.*—The species is named for the long, slender fixed finger.

*Upogebia thistlei* new species

Figure 17

*Upogebia rostrispinosa* Bott 1955:49 (part), SMF 2117, 2 ♂, 1 ♀ Paratypes; El Salvador, Puerto El Triunfo.

*Material examined.*—Mexico: Baha California Norte.



AHF—02-06 (Paratype 7611) 1 ♂, 3 mi N San Felipe, muddy sand flats, water 12°–13°C, R. C. Brusca and B. Wallerstein, 1 January 1976; 2577-01, 1 ♀ (exuvium), 1 mi N San Felipe, 100 ft beach seine, R. H. Linsley, 15 March 1956; 1537-01 (Paratypes 798) 3 ♀, Bahía de Los Angeles, shore, rocks on sand, low tide, 62°F, R. C. Brusca, 4/5 January 1979.

USNM—213241, 1 ♀, San Felipe, S. A. Glassell, 8 May 1937.

#### Baja California Sur.

AHF—2538-01 (Paratype 4014) 1 ♀, Puerto Escondido, mouth of lagoon, *Velero III* sta. 1094-40, 10 February 1940.

USNM—213242, 1 ♂, Bahía Concepción, shore Bahía Coyote, 16 March 1937; 213243, 1 ♂, 2 ♀, Puerto Escondido, off Carmen Is., off lagoon entrance, AHF 670-37, 12 March 1937 (one ♀ specimen lacks anterior ventrolateral spine on carpus of cheliped); 213244 (Paratype) 1 ♂, Isla Espíritu Santo, Cove S of Bahía de Ballenas, *Velero III* sta. 510-36, 22 February 1936; 213245, 1 ♂, Bahía San Gabriel, Isla Espíritu Santo, Ricketts, 12 April 1940; 213246, 1 ♀, Bahía de la Paz, *Albatross*, 12 March 1889.

#### Sonora.

AHF—2578-01, 1 ♀ (? immature near *thistlei*), Estero Soldado, Bahía San Carlos just N Guaymas; J. Wintz, C. Philippi; 2539-01, 1 ♀?, Bahía de Guaymas, shore, *Velero III* sta. 1041-40, 23 January 1940.

USNM—213240 (Paratype) 1 ♀, Punta Cholla, S. A. Glassell, 23 April 1940.

#### El Salvador.

NMS—2361 (Paratypes) 1 ♂, 3 ♀, 2 juvs., Puerto El Triunfo, Peters col.

#### Panama.

USNM—312247, 8 juvs., Venado Beach, 8°53.5'N, 79°36.5'W, rocky tide pool 100–200 yd from shore, M. L. Jones, 23-1, 25 April 1971, poison; 213248, 1 ♂, Venado Beach, about ¾ way to Venado Is., tide pools and streams to either side of connecting sandbar, 0–2 ft, C. E. Dawson, 1529, 19 March 1972, ichthyocide; 213249, 4 juvs., east end Venado Beach, approx. 8°53'25"N, 79°35'45"W, tide pools, rocks and flats, 0–3 ft, C. E. Dawson, 2002, 26 November 1966, Chem-fish; 213250, 3 ♀, Fort Kobbe Beach, ca. 8°53'45"N, 79°34'35"W, 0–2 ft,

sand, mud, rocks, low tide, C. E. Dawson, 1416, 4 June 1970, Chem-fish; 213251 (Holotype) 1 ♀ (ovig.), Pilot Pier area near Naos Is., intertidal rock, mud, sand, 27.8°C, 26.2‰, Kaufman and Jones, 105, 1 November 1972; 213252 (Paratypes) 1 ♂, 1 ♀, same; 213253, 5 juvs., Pilot House Beach, Naos Is., C.Z., transect from 1.5 m depth at low water, 28°C, 22‰, M. L. Jones, 264-1, 21 July 1978; 213254, 2 ♀, Naos Is., NE end of causeway, 8°56'07"N, 79°32'47"W, 0–6 cm, gravel and sand, low tide, 24.5°C, 33.5‰, C. E. Dawson, 1531, 12 April 1972, ichthyocide; 213255, 1 ♀, Naos Is., causeway, rock pile and sand, canal side, 0.13 m, C. E. Dawson, 1772, 21 July 1978; 21356, 1 ♀ (ovig.), Scout Beach, Naos Is., 0–1 m, rock and fine sand, low tide, C. E. Dawson, 1647, 29 October 1973; 213257, 2 ♀ (1 ovig.), Ft. Amador, Culebra Is., 08°54.8'N, 79°31.9'W, canal side, intertidal rocks, R. B. Manning, M. L. Jones et al., 28-2, 28 April 1971; 213258, 1 ♂, Panama Reef off French Fort, 8°56'45"N, 79°31'45"W, 0–2 ft, rock tide pools and channels, silt, sandy gravel, 32°C, 25‰, low tide, C. E. Dawson and party, 1507, 6 November 1971, ichthyocide; 213259, 1 ♂, E side Punta Paitilla Beach, off Union Club, Panama City, 8°58.5'N, 79°30.8'W, rocky intertidal pool ca. 6 ft below HWM, 0–3 ft, M. L. Jones, 25-7, 26 April 1971; 213260, 1 ♂, Punta Paitilla 1 m at low tide over shell hash and silt, 28°C, 28‰, M. L. Jones, 246-1, 9 January 1978; 213261, 1 ♂, Perlas Is., E side Chapera Is., 8°53.6'N, 79°01.4'W, shore, rocks and sand, Manning et al., 40, 1 May 1971; 213262, 1 ♀, shore of Panama, low tide, rocks, E. Deichmann, May–July 1924.

#### Colombia.

USNM—213263 (Paratypes) 1 ♂, 1 ♀, Bahía Cueva (C. Corrientes), shore collecting near stream; W. L. Schmitt, AHF 229-34, 13 February 1934; 213264, 1 ♂, 1 ♀, La Bocana beach near Buenaventura, intertidal under rocks, W. L. Klawe, Inter-American Tropical Tuna Commission, 25 November 1965, Cruise: ACENTO 3.

#### Ecuador.

USNM—213265 (Paratype) 1 ♀, Las Palmas, Prov. Esmeraldas (near Esmeraldas), from tide pool at low tide; Fugler and Loesch, 27–29 March 1963.

*Diagnosis.*—As *U. galapagensis* except chelipeds more robust and with carpus bearing spine (often small) at anterior ventrolateral corner.

*Description.*—Rostrum triangular, straight, exceeding eyestalks; pair of short subapical spines fol-

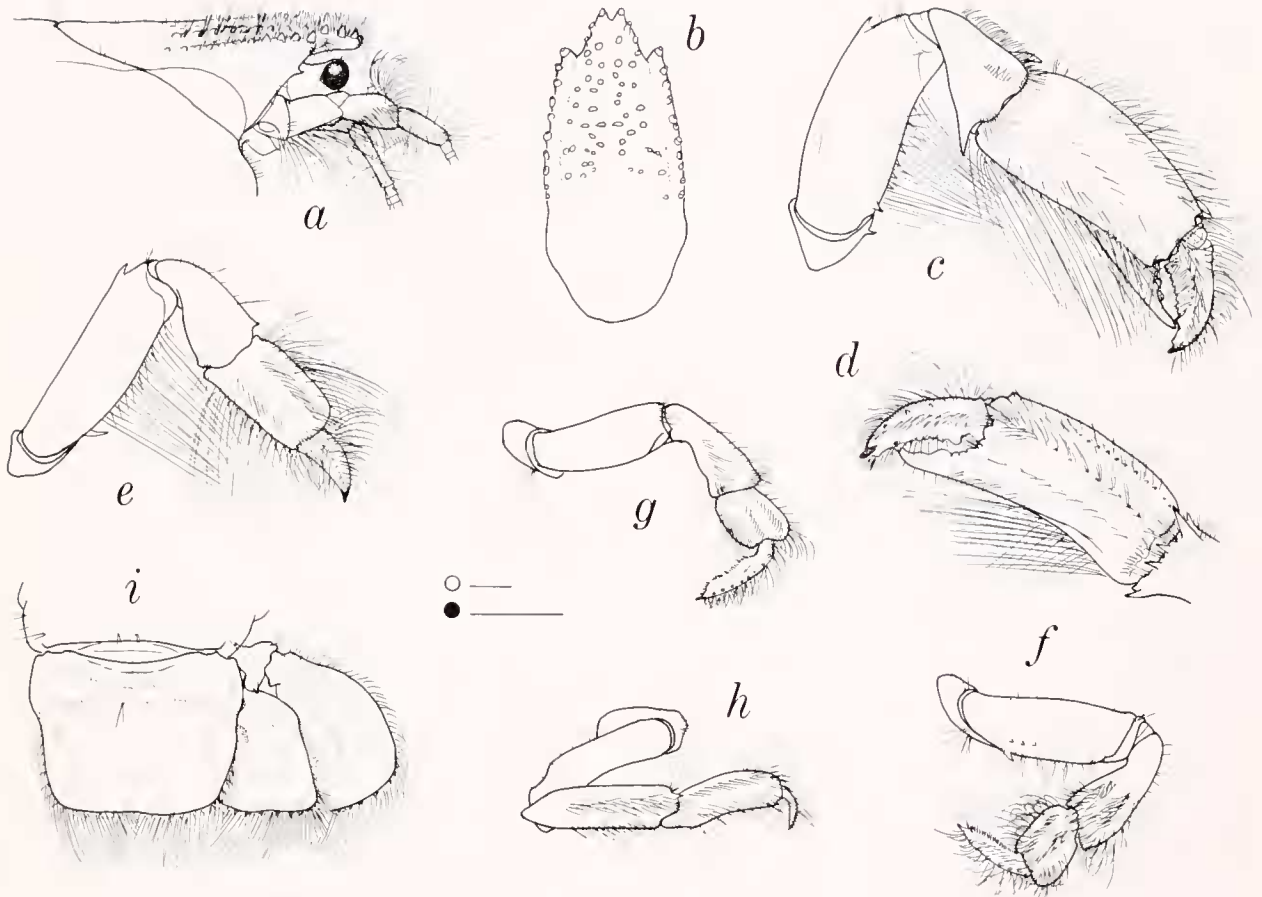


Fig. 17. *Upogebia thistlei* new species. a, Cephalic region, lateral; b, Anterior carapace, dorsal; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2-5; i, Telson and right uropods. USNM 213251, ♀ Holotype. Scales = 1 mm; O = c, d, e, f, g, h; ● = a, b, i.

lowed on each side by 3 spines of almost equal size, central dorsal surface spineless but with 2 spines near base, merging with pilose field of spines and tubercles on anterior  $\frac{2}{3}$ , latter diminishing in size from anterior dorsal part to obsolescence posteriorly and angling toward sides; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 11-12 spines decreasing from strongest on lateral rostral process to obsolescence posteriorly. Cervical groove deep and continuous, shoulder lateral to it smooth or bearing small tubercles; thalassinidean line continuing to posterior margin of carapace. Postocular spine present.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2-5 broadly rounded, margins unspined; dense fine plumose setae laterally on posterior margin of segments 3 and 4 and in tracts on pleura of segments 3-5; segment 6 rectangular, wider

than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression.

Telson rectangular, a little wider than long but broadest proximally; angle on anterolateral margin interlocking with groove on central rib of uropodal endopod; distal margin slightly indented medially and densely fringed with setae; transverse anterior ridge fairly prominent and continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk reaching about level of space between first and second dorsal spines on rostral margin; more or less cylindrical, very slightly swollen ventrally; cornea of good size facing both laterally and anteroventrally.

Antennular peduncle reaching to between base and midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as slender terminal article; flagella unequal, lower thinner ramus clearly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{2}$  its length ex-

tending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval, sometimes with minute terminal spine.

Mouthparts as figured for *U. jonesi*; maxilliped 3 with epipod.

Epistomial projection rather broad in lateral view, bearing 1 spine at anterolateral angle.

Chelipeds essentially equal. Ventral margin of ischium bearing 1 small spine. Merus with single subdistal dorsal spine reaching level of postocular spine, row of 5 small to moderate spines on proximal  $\frac{2}{3}$  of ventral margin. Carpus trigonal, a shallow longitudinal groove laterally and small spine at ventrolateral corner; mesiodorsal crest of almost uniform small spines behind prominent spine on anterior margin, all directed forward; 2 strong spines below latter on distomesial margin, ventral one largest; distoventral spine strong. Palm oval in cross section, length including fixed finger about 2.2–2.7 times maximal height, depending on size; prominent setae in 4 dorsal rows, longer in ventral tract, some setae along low lateral ridge; incomplete dorsal crest of low forwardly directed spines flanked on each side by spineless crest; lateral condyle of dactyl with obsolescent spine below it, mesial condyle with stout spine below followed by 4 or 5 small teeth on anterior margin of palm; mesioproximal surface bearing granular vertical ridge. Fixed finger somewhat less than  $\frac{1}{2}$ – $\frac{2}{3}$  length of dactyl, slightly curved and tapered to moderately slender tip in female, stouter in male, and with 3–5 teeth on prehensile edge proximally. Dactyl slightly curved and stouter than fixed finger, corneous slender tip preceded by low tooth on prehensile edge and then row of about 7 calcareous teeth ending in strong tooth near proximal toothless space; 2 rows of obscure tubercles mesially and row of tubercles with scattered outliers proximally on dorsal surface.

Leg 2 reaching about to distal  $\frac{1}{4}$  of palm; carpus with acute distodorsal spine and blunter subdistal ventral spine; elongate merus with slender dorsal, subdistal spine, mesioventral spine strong. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with single mesioventral spine. Leg 4 with spineless merus. Leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with spine on protopod (occasionally bifid) overhanging base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with minute scattered spines on

distal margin and dense fringe of setae; endopod with low, median longitudinal rib and less prominent lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing rather blunt spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype female, length anterior carapace 7.7, length carapace 11.0, length chela including fixed finger 6.8, height chela 2.7. Paratype male, same, 5.8, 8.1, 5.5, 2.2.

*Known range.*—Gulf of California to northern Ecuador.

*Remarks.*—*Upogebia thistlei* most closely resembles *U. galapagensis*, from which it differs in having more robust chelae bearing a small spine at the anterior ventrolateral corner of the carpus. It resembles *U. spinigera* and *U. longipollex* in spination of leg 2, but the carpus of the cheliped bears 3 strong spines mesially whereas that of *U. longipollex* has the middle one of these spines poorly developed and *U. spinigera* almost always lacks this spine. Though the short rostrum of *U. thistlei* bears some resemblance to that of some *U. spinigera*, its dorsal surface is spineless except for the marginal and terminal armature. Abdominal segments 1 and 2 and the merus of leg 4 are spineless in *U. thistlei*, whereas those abdominal segments are always spined in *U. longipollex* and are often so in *U. spinigera*. The merus of leg 4 is spined in *U. spinigera*, but never so in the other two species. The eyestalk of *U. thistlei* is less swollen ventrally than in the other two species, giving it the appearance of being directed anteriorly rather than anterodorsally.

Males may have small oviducal openings (false hermaphrodites).

W. L. Schmitt gave color of the male and female in USNM 213263 as “ochraceous buff tinged also with salmon buff (being little more pinkish than the o.b.).”

*Name.*—The species is named for David Thistle, Department of Oceanography, Florida State University, Tallahassee, who recognized that some specimens in NMS 2117 belong to a species other than *U. rostrispinosa* Bott.

#### *Upogebia veleronis* new species

Figure 18

*Material examined.*—Mexico.

USNM—213272 (Holotype) ♀ (ovig.), Isla María Magdalena [21°25'N, 106°24'W], Islas Tres Marías,



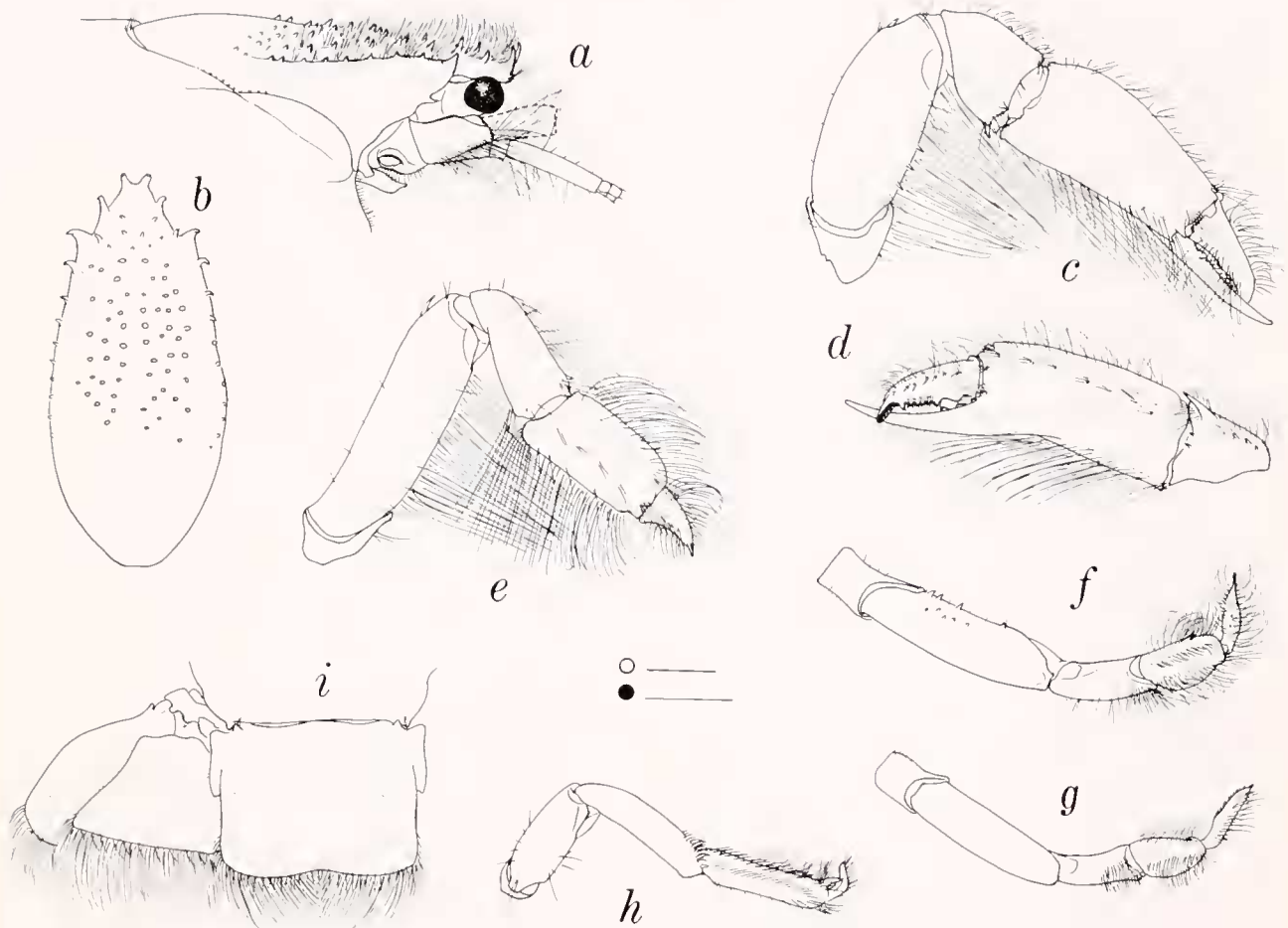


Fig. 18. *Upogebia veleronis* new species. a, Cephalic region, lateral; b, Anterior carapace; Cheliped, c, lateral, d, mesial; e, f, g, h, Legs 2-5; i, Telson and left uropods. USNM 213272, ♀ Holotype. Scales = 1 mm; ○ = c, d, e, f, g, h, i; ● = a, b.

coralline and algal bottom, 13 fm, *Velero III* 970-39, 9 May 1939.

Ecuador.

USNM—213274 (Paratypes) 2 ♂, 1 ♀, Cabo San Francisco, dredging near rocks, mud and rock, 2 fm, *Velero III* 214-34, W. L. Schmitt, 11 February 1934.

**Diagnosis.**—Postocular spine present. Rostrum with extremity very slightly exceeding that of eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson essentially rectangular. Cheliped with fixed finger as long as dactyl; palm spineless mesially posterior to base of fixed finger; ischium spineless on ventral margin. Leg 2 without proximal mesio-ventral spine on merus; merus of leg 4 lacking ventral spines.

**Description.**—Rostrum broadly triangular, slightly downturned; tip surmounted by pair of strong, slightly backward curved apical dorsal spines situ-

ated side by side and followed on each side by 2 somewhat smaller spines of about equal size; central dorsal rostral surface bearing tufts of setae but almost spineless, merging with pilose field of spiniform tubercles and tubercles diminishing over approximately  $\frac{3}{4}$  of anterodorsal carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by posteriorly divergent ridge bearing similar crest of about 9-12 spines decreasing from largest on lateral rostral process posteriorly. Cervical groove deep and continuous, rather sharp shoulder lateral to it bearing 0-1 granule (often ill defined) below level crossed by thalassinidean line, latter continuing to posterior margin of carapace. Postocular margin bearing spine.

Abdomen broadly and smoothly arched dorsally; pleura of segment 1 narrowly rounded posterolaterally, those of 2-5 broadly rounded, margins un-

spined; dense fine setae in tracts on pleura of segments 3–5 and tuft on posterolateral corner of 2; segment 6 rectangular, wider than long, lateral margin sinuous, notch anterior to posterolateral lobe continuous with oblique groove and lunate dorsal impression; lobe anterior to notch rather angular.

Telson rectangular, sides slightly lobed anteriorly, distal margin shallowly biarcuate and densely fringed with setae; transverse anterior ridge continuous with low lateral ridge at each side, median groove obsolescent.

Eyestalk reaching to base of dorsal spines at rostral tip; more or less straight; cornea rather large but no broader than eyestalk, directed anteriorly and laterally.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal 2 articles together about as long as terminal article; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 bearing small subdistal ventral spine; scale small, oval, and tipped with seta.

Mouthparts as figured for *U. pugettensis*; maxilliped 3 bearing epipod.

Epistomial projection broad in lateral view, bearing single small acuminate spine.

Chelipeds essentially equal, rather slender. Ventral margin of ischium spineless. Merus with 2 or 3 spines on ventral margin; subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, an obsolescent longitudinal groove laterally, and an obsolescent spine at anterior ventrolateral corner; 1 or more mesiodorsal forwardly directed, uniform small (obsolescent) spine(s) behind and rather remote from prominent spine on anterior margin; latter flanked by 2 tiny spines on anterodorsal margin and followed below on distomesial margin by 2 tiny spines; distoventral spine slender and small. Palm oval in cross section, length on female including fixed finger about 2.7–3.4 times maximal height, depending on size, stouter in male; prominent setae in faint dorsal rows, longer in ventral tract, some setae along low lateral ridge; dorsal crests obsolescent; lateral condyle of dactyl with obsolescent small spine below it. Fixed finger fully as long as dactyl, slender and gently curved; 3 teeth on proximal part of prehensile edge. Dactyl slightly curved, setose, stouter than fixed finger, and tapered to slender tip corneous along prehensile edge; dentate crest of 5 moderate teeth on prehensile edge.

Leg 2 reaching about to distal  $\frac{1}{4}$  palm of cheliped; carpus with small subdistal dorsal spine; elongate

merus with slender subdistal dorsal spine. Leg 3 with slender pointed dactyl extending beyond rostrum; merus with cluster of spines proximoventrally; carpus of both sexes bearing strong ventral spine. Leg 4 with spineless merus. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

Uropod with obsolescent spine on protopod at base of endopod; straight distal margin of endopod exceeded by curved margin of exopod, both rami with dense fringe of setae distally; endopod with rather prominent median longitudinal rib and lateral rib having shallowly concave margin except for rounded, proximal shoulder; exopod with 3 ribs, mesial strongest one bearing obsolescent spine proximally, intermediate rib longer, lateral rib least evident of all, slightly curved outward but shallowly concave proximally.

*Measurements (mm).*—Holotype female, length anterior carapace 5.0, length carapace 7.2, length chela including fixed finger 5.4, height chela 1.6. Paratype male, same, 3.2, 4.6, 3.5, 1.3.

*Known range.*—Islas Tres Marias, Mexico, and Ecuador.

*Remarks.*—*Upogebia veleronis*, a member of the group of species having no proximal spine on the merus of leg 2, seems most closely allied with *U. macrariae* found in the same geographic area, but the species differ in several respects. *Upogebia veleronis* has a spineless ischium on the chelipeds, but relatively longer and more numerous spines on the anterior carapace and rostrum, and a larger cornea than *U. macrariae*. The species are similar in having long, slender fingers on the chelipeds, but the spination of the chelae is different. Both species resemble *U. brasiliensis* of the Atlantic.

All the specimens of *U. veleronis* studied are fragmentary. The holotype female lacks antennae, the left cheliped, right leg 3, and the dactyl on the right leg 4. The paratypes are broken and/or missing some legs, but the antennal peduncles of all are in place.

*Name.*—The species is named for the Allan Hancock Foundation R/V *Velero III* with the aid of which this and many other decapod crustacean species were collected in the eastern Pacific.

#### *Upogebia ramphula* new species

Figure 19

*Material examined.*—Mexico: Nayarit.

USNM—213446 (Holotype) ♂, Isla María Madre, 21°35'N, 106°33'W, 4–10 fm, G. H. Hanna and E.

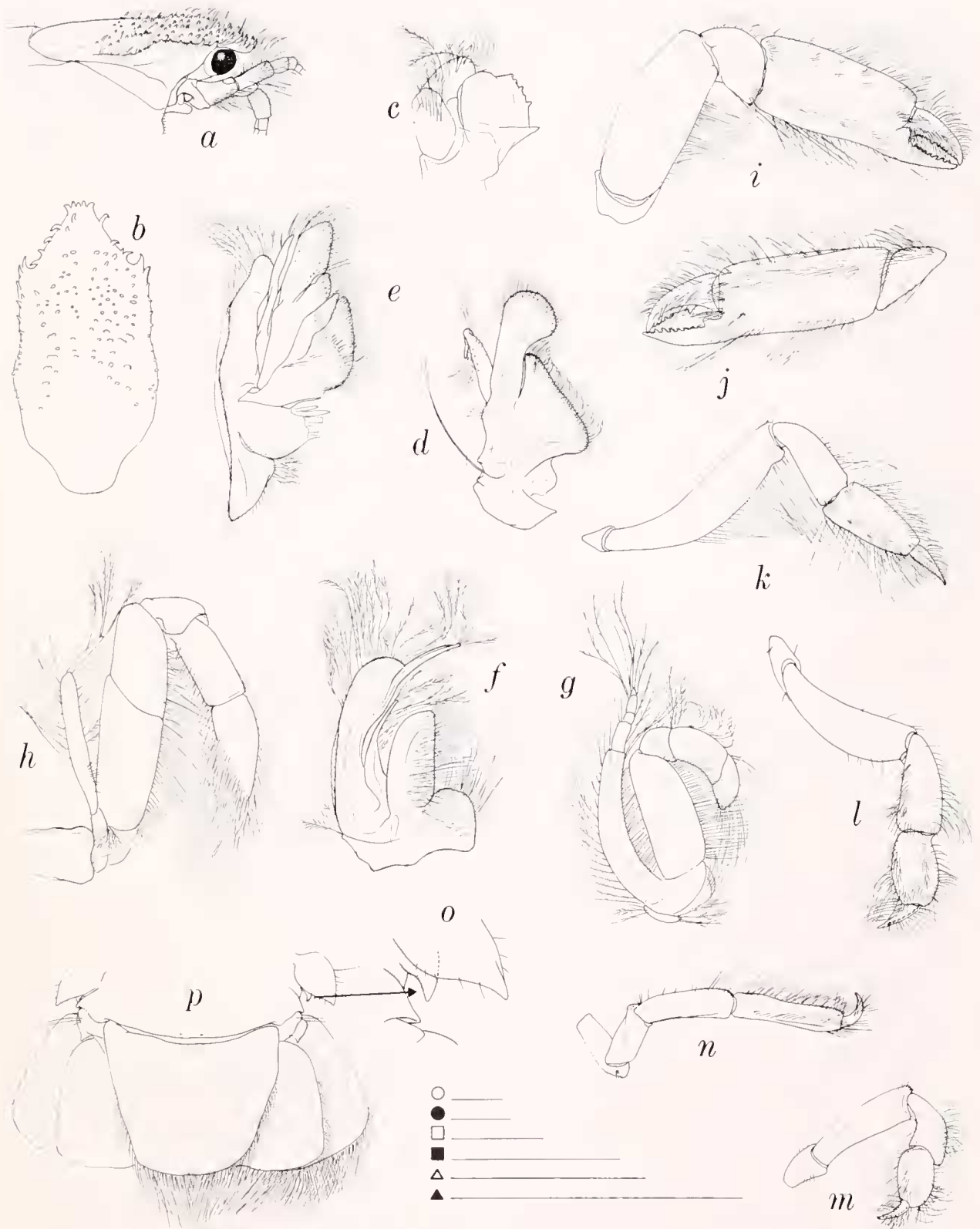


Fig. 19. *Upogebia ramphula* new species. *a*, Cephalic region, lateral; *b*, Anterior carapace, dorsal; *c*, Mandible; *d*, *e*, Maxilla 1, 2; *f*, *g*, *h*, Maxilliped 1, 2, 3; Cheliped, *i*, lateral, *j*, mesial; *k*, *l*, *m*, *n*, Legs 2-5; *o*, abdominal segment 6, dorsal of right side (arrow); *p*, Telson and uropods. USNM 213446, ♂ Holotype, except *o* from ♀ Paratype USNM 213278, mouthparts from USNM 213447. Scales = 1 mm; ○ = *a*, *i*, *j*, *k*, *l*, *m*, *n*, *p*; ● = *b*; □ = *o*; ■ = *h*; △ = *d*, *e*, *f*, *g*; ▲ = *c*.



K. Jordan, CAS Exped. to Islas Revillagigedo, 1925; 213278 (Paratype) 1 ♀ (ovig.), same (weakly calcified or imperfectly preserved); 213447 (Paratype) 1 ♂, same.

*Diagnosis.* — Projections to either side of rostrum ending in acute spine. Postocular spine absent. First and second abdominal segments lacking ventral spines; sixth segment bearing hooked anterolateral process; telson narrowed posteriorly. Chelipeds with fully developed fixed finger equal to dactyl in length; legs spineless.

*Description.* — Rostrum triangular in dorsal view, broader than long and bearing mat of rather long silky setae tending to obscure backward curved, slender spines (4) at broad tip and (4–5) along margins; tip turned downward, exceeding eyestalks; surface posterior to this setate and studded with scattered spiniform tubercles anteriorly but grading to smooth on gastric region posteriorly; ornamented part separated from and flanked on each side by slightly sinuous ridge bearing similar crest of about 16–18 spines grading from slender anteriorly on lateral rostral process to sharp tubercles posteriorly. Postorbital spine absent. Shoulder lateral to cervical groove not prominent; thalassinidean line faint but extending to posterior margin of carapace.

Abdomen weakly sclerotized; first 2 segments lacking spines or spinules on sterna, pleura and bases of pleopods; pleura of segment 1 very poorly developed, of 2–5 rather well developed and bearing plumose setae on margins, but sparsely on ventrolateral portions, pilose tract extending dorsally to some extent near anterior and posterior margin of tergum on segment 3, scattered setae elsewhere dorsally; segment 6 broader than long, bearing hooked, acute process on anterolateral margin and behind it a triangular lobe; marked dorsally with shallow median longitudinal furrow and lateral to this on each side an obsolescent, irregularly lunate furrow.

Telson broader at base than long, somewhat narrowed and rounded posteriorly, and with median longitudinal furrow; as long as uropods.

Eyestalk rather stout, clearly exceeded by rostrum; cornea large but narrower than base of eyestalk in lateral view and directed anterolaterally.

Antennular and antennal peduncles with articles unspined; scale on latter minute.

Mouthparts as figured; epipod of maxilliped 1 minute, maxilliped 3 lacking epipod.

Extension of epistome spineless in lateral view.

All legs with smooth, spineless articles; bearing usual tracts of long, silky setae. Chelipeds equal, moderately robust, depth of palm about  $\frac{1}{2}$  length;

fingers elongate, gently curved toward each other and tapering to tip; fixed finger with prehensile edge serrate, teeth (about 10 and somewhat separated) diminishing in size to slender tip; dactyl stouter, also serrate on prehensile edge but toothless proximal  $\frac{1}{4}$  followed by 2 slightly enlarged teeth, then row of 10–12 appressed smaller teeth set apart from slender tip.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4 (but poorly preserved).

Pleopods distally setose, exopod far longer and broader than endopod.

Both rami of uropods with convex distal margin, obsolescent spine on protopod lateral to articulation of endopod; larger acute spine proximally on prominent rib of exopod.

*Measurements (mm).* — Holotype male, length anterior carapace 5.1, length carapace 7.0, length chela including fixed finger 2.7, height chela 0.8. Paratype ovigerous female, same, 2.6, 3.2, 2.5, 0.8; eggs approximately 0.6 mm in diameter.

*Known range.* — Confined to type-locality.

*Remarks.* — *Upogebia ramphula* has some resemblance to *U. darwinii* (Miers 1884) of northern Australia which has a well-developed anterolateral lobe on abdominal segment 6 in the position occupied by the distinctive process of *U. ramphula*, in spination of the ridge paralleling the anterior carapace, and in chelae having extended curved fingers of equal length, though in *U. darwinii* the dactyl is much stronger than the fixed finger, and is ridged and ornamented with setae that recall the pattern seen in the majority of upogebian species. *Upogebia darwinii*, however, has much shorter eyestalks than *U. ramphula*, and it has a row of small ventral spines on the ischium and merus of the cheliped, whereas that of *U. ramphula* is unspined.

*Upogebia ramphula* stands alone among the eastern Pacific species of the genus in several respects. The rather distinctive flattened anterior carapace spined on its margins but otherwise moderately setose and tuberculate, the rather broad laterally setose abdomen with hooked process on the lateral margin of segment 6, the somewhat operculiform tail fan with distally narrowed telson and both rami of uropods with rounded distal margin, the spineless legs, the chelipeds with fully developed fixed finger and dactyl comparable in size and shape, and the lack of a rudimentary epipod on the third maxilliped combine to put this species into a category that, in its own way, is as far removed from the great number of "typical" *Upogebia* species in the western hemi-

sphere as are the operculate *U. cocosia* and *U. rugosa* treated below.

When the genus as a whole is reviewed, these small species may come to be regarded as two groups at least subgenerically distinct from the much larger "typical" *Upogebia*.

*Name*.—The specific name is derived from the Greek "rhamphus," hooked beak or knife, and the diminutive "ula," with reference to the hooked anterolateral process on abdominal segment 6.

*Upogebia cocosia* new species

Figure 20

*Material examined*.—Costa Rica.

USNM—213268 (Holotype) ♂, Cocos Is., divers at anchorage (W. L. Schmitt) 26 April 1941; 213269 (Paratypes) 3 ♂, 3 ♀ (ovig.), same; 1 ♂ being transferred to AHF.

*Diagnosis*.—Postocular spine absent. Rostrum clearly exceeding eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson with distal margin wider than proximal margin. Cheliped with fixed finger nearly as long as dactyl; palm spineless mesially posterior to base of fixed finger; ischium spineless. Legs 2 and 4 spineless.

*Description*.—Much of integument smooth and shining, or iridescent. Rostrum deep and broadly subtriangular, extending more or less straight forward, sometimes with single upturned spine at tip, ill defined margin on each side bearing 1–2 spine(s); central dorsal surface bearing tufts of setae but almost spineless and merging with similar field over approximately  $\frac{2}{3}$  of anterodorsal carapace and angling toward sides posteriorly, spiny and setate anteriorly but becoming tuberculate without setae posteriorly, gastric part posterior to this smooth; ornamented part separated from and flanked on each side by ridge bearing crest of about 4 strong acute spines on more or less straight anterior part, then diverging posteriorly and bearing row of about 8 smaller almost uniform spines. Cervical groove deep and continuous, rather sharp shoulder lateral to it often bearing irregular spines above and below level crossed by thalassinidean line, latter obscure but continuing to posterior margin of carapace. Postocular margin sinuous and spineless.

Abdomen broadly and smoothly arched dorsally on segments 1–4, dense fringe of setae on posterior margin of segment 4; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae in tracts

on pleura of segments 3–4, tuft on posterolateral corner of 2 and anterolateral corner of 5; segment 6 irregularly rectangular, broader than long, its lateral margin scalloped anteriorly and fitted posteriorly for articulation with base of uropod; dorsal surface of segments 5 and 6 ornamented with rather bold symmetrical pattern of meandering rugae.

Tail fan with exposed aspect generally concave. Telson with sides diverging posteriorly, stiffened with 6 radiating longitudinal ribs, laterals running length of margin; mesial and submesial pairs originating in raised weakly eroded anterior region, flaring slightly, and becoming weakly but irregularly eroded posteriorly; submesial pair with poorly developed spines on anterior raised part and 1 or 2 remote spinules posteriorly; uropods similar in structure. Entire tail fan with dense fringe of setae on distal margin and, together with segments 5 and 6, forming an almost circular operculum when fully extended.

Eyestalk reaching to midlength or distal end of second article of antennular peduncle; fully exposed to lateral view; cornea half as long as stalk, directed anterolaterally, a tiny tubercle or spine at antero-mesial emargination.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal article broad basally and about as long as strongly compressed 2 distal articles together; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about  $\frac{2}{3}$  its length extending beyond tip of rostrum; article 2 bearing strong subdistal ventral spine; scale obsolete.

Mouthparts as figured for *U. rugosa*; maxilliped 3 lacking epipod.

Epistomial projection in lateral view broad, subtruncate to somewhat elongate, spineless.

Chelipeds equal, rather slender. Articles spineless. Carpus trigonal, shallow longitudinal groove laterally, obsolescent spine at anterior end of dorsal crest; dense plumose setae in dorsal and dorsomesial tract. Palm oval in cross section, length on female including fixed finger about 2.6–3.2 times maximum height, stouter in males, fingers more extended in female than in male; prominent hairs in row of scattered sparse tufts on upper mesial surface, more dense along low lateral ridge, much longer in ventral tract; mesial and lateral condyles of dactyl fairly prominent. Fixed finger nearly as long as dactyl, rather stout and gently curved; few obsolescent teeth on proximal part of prehensile edge. Dactyl curved, setose, stouter than fixed finger, abruptly tapered to tip and hooking beyond tip of opposed finger when

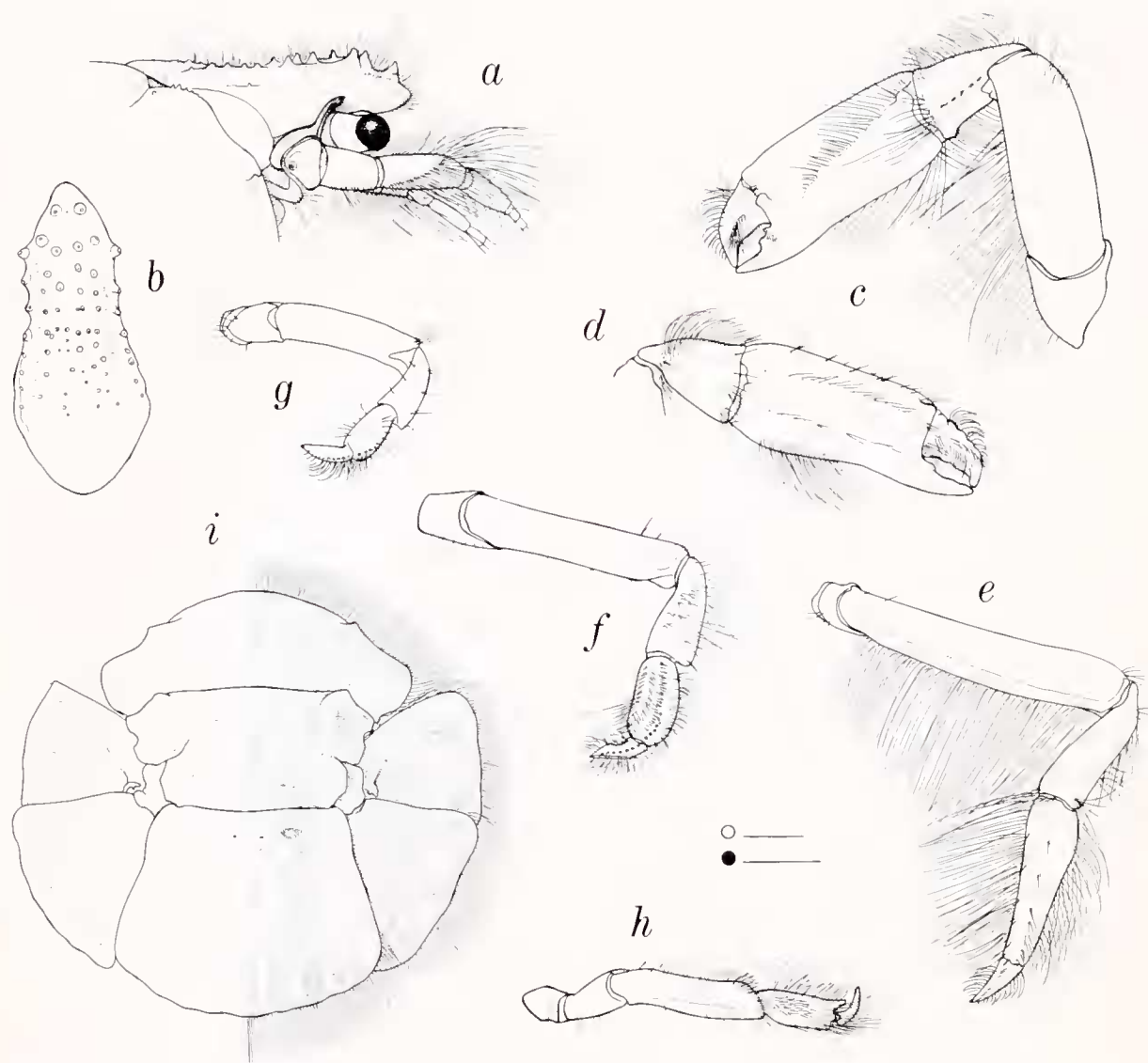


Fig. 20. *Upogebia cocosia* new species. *a*, Cephalic region, lateral; *b*, Anterior carapace, dorsal; Cheliped, *c*, lateral, *d*, mesial; *e*, *f*, *g*, *h*, Legs 2-5; *i*, Caudal opercular complex, abdominal segments 5-6, Telson and uropods. USNM 213268, ♂ Holotype. Scales = 1 mm; ○ = *c*, *d*, *e*, *f*, *g*, *h*, *i*; ● = *a*, *b*.

closed; dentate crest of small teeth on cutting edge along distal  $\frac{2}{3}$  of length.

Leg 2 spineless, slender, merus reaching to cover base of antenna; carpus elongate; propodus and dactyl tapering to acute tip. Legs 3 and 4 similar, successively shorter, with propodus not tapered but dactyl slender, both these articles setose and bearing line of closely spaced granules laterally.

Subchelate leg 5 reaching beyond base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1-4.

*Measurements (mm).*—Holotype male, length anterior carapace 4.3, length carapace 6.7, length chela

including fixed finger 4.4, height chela 1.7. Paratype female, same, 4.1, 6.4, 4.1, 1.3.

*Remarks.*—The collection of specimens described here was taken by navy divers during an expedition from Panama to the Galapagos Islands that returned in April 1941. Dr. W. L. Schmitt was a participant aboard the converted mine sweeper USS *Mallard* which accompanied six submarines. His diary records that the *Mallard* visited Cocos Island on only the day the collection was made, and other than routine weather observations the only pertinent field note is, "P.M. put away diver col." Other locality data are on a handwritten note in the collection bottle.



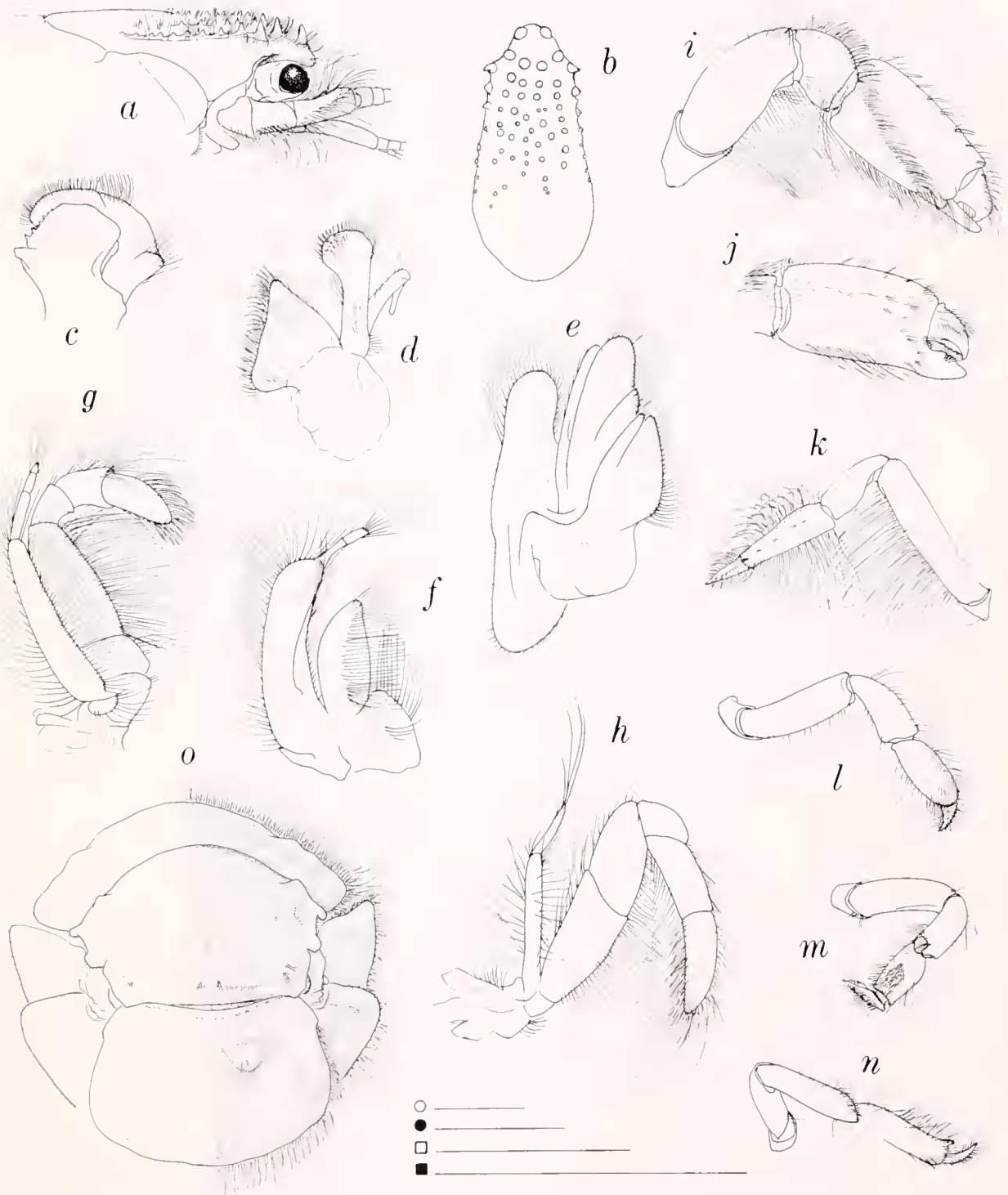


Fig. 21. *Upogebia rugosa* (Lockington). a, Cephalic region, lateral; b, Anterior carapace, dorsal; c, Mandible; d, e, Maxilla 1, 2; f, g, h, Maxilliped 1, 2, 3; Cheliped; i, lateral; j, mesial; k, l, m, n, Legs 2-5; o, Caudal opercular complex, abdominal segments 5-6, Telson and uropods. USNM 213276, o, mouthparts from ♀. Scales = 1 mm; ○ = a, b, o; ● = h, i, j, k, l, m, n; □ = d, e, f, g; ■ = c.

*Upogebia cocosia* belongs to a distinct group of species that was formerly considered to comprise the subgenus *Calliadne* Stahl, 1861 (de Man 1928). The tail fan and last two abdominal segments can form an opercular plug to the opening of the burrow in which the animals live. This caudal operculum has a surface that appears eroded, strongly resembling the eroded surface of coral or rock, and records in the USNM state that one of the species in the group, *U. operculata* Schmitt (1924) of the Caribbean region, can live imprisoned in often U-shaped tubes in coral reefs.

The only other known representative of this group in the eastern Pacific is *U. rugosa* (Lockington), which *U. cocosia* resembles; but *U. operculata* is a more closely allied, possibly geminate species. Differences among these forms are set forth in the key to species.

*Name.*—The name refers to Cocos Island.

*Upogebia rugosa* (Lockington)

Figure 21

*Gebia rugosa* Lockington 1878:300.

*Upogebia (Upogebia) rugosa.*—Borradaile 1903:543 (list).

*Upogebia (Gebiopsis) rugosa.*—Schmitt 1924:91, 93 (comparisons).

*Upogebia (Calliadne) rugosa.*—De Man 1928:24, 50 (list and annotated key).

*Upogebia rugosa.*—Thistle 1973:1–23 (passim, key).—Brusca 1973:223 (list); 1980:259 (list).

*Material examined.*—Mexico: Baha California Sur.

AHF—2535-01, 1 ♀, Bahía Agua Verde, 25°31'05"N, 110°02'30"W, seine, shore [?], *Velero III* sta. 1103-40, 12 February 1940; 2545-01, 2 ♂, 2 ♀; Bahía Agua Verde, 25°31'N, 110°01'45"W, 10 fm, mud, coral, *Velero III* sta. 1101-40, 12 February 1940.

USNM—213276, 1 ♂, 1 ♀, Bahía Agua Verde, 25°31'N, 110°01'45"W, 10 fm, mud, coral from AHF 2545-01, *Velero III* sta. 1101-40, 12 February 1940.

*Diagnosis.*—Postocular spine absent. Rostrum clearly exceeding eyestalks. Abdominal segments 1 and 2 lacking ventral spines. Telson with posterior margin wider than anterior margin, longitudinally ribbed, few spinules near base of submesial rib. Cheliped with fixed finger nearly as long as dactyl; palm spineless mesially posterior to base of fixed finger; ischium spineless. Legs 2–4 spineless.

*Description.*—Much of integument smooth and shining or iridescent. Rostrum deep and broadly subtriangular, extending more or less straight for-

ward, upper margin somewhat inclined anteriorly and bearing pair of moderate subapical dorsal spines situated more or less side by side and followed after an interval on each side by 1 spine of about equal size; central dorsal rostral surface bearing tufts of setae but spineless, merging with pilose field of spiniform tubercles and tubercles diminishing over approximately  $\frac{2}{3}$  of anterodorsal carapace and angling toward sides posteriorly; gastric part posterior to this smooth; ornamented part separated from and flanked on each side by ridge bearing similar crest of about 4 strong acute spines on more or less straight part, followed by series of about 6 smaller spines becoming obsolescent on divergent part posteriorly. Cervical groove deep and continuous, rather sharp shoulder lateral to it often bearing irregular spines above and below level crossed by thalassinidean line, latter obscure but continuing to posterior margin of carapace. Postocular margin sinuous and spineless.

Abdomen broadly and smoothly arched dorsally, dense fringe of setae on posterior margin of segment 4; pleura of segment 1 narrowly rounded posterolaterally, those of 2–5 broadly rounded, margins unspined; dense fine setae in tracts on pleura of segments 3–5 and tuft on posterolateral corner of 2; segment 6 irregularly rectangular, broader than long, its lateral margin scalloped anteriorly and fitted posteriorly for articulation with base of uropod; dorsal surface of segments 5 and 6 ornamented with symmetrical pattern of obsolescent, broad, meandering ridges and grooves.

Tail fan with exposed aspect generally concave. Telson with sides diverging posteriorly, stiffened with 6 obsolescent longitudinal ribs; laterals running length of margin; mesial and submesial pairs originating in slightly raised and almost imperceptibly eroded anterior region, bearing few spinules on either side, flaring a bit and becoming very weakly but irregularly eroded posteriorly. Uropods similar in structure, bearing line of faint granules on distal margin. Entire tail fan bearing dense fringe of setae on distal margin, and together with segments 5 and 6 forming an almost circular operculum when fully extended.

Eyestalk reaching to midlength or distal end of second article of antennular peduncle; fully exposed to lateral view; cornea half as long as and more slender than stalk, directed anteriorly.

Antennular peduncle reaching to about midlength of terminal article of antennal peduncle, its proximal article broad basally and about as long as strongly compressed 2 distal articles together; flagella unequal, lower thinner ramus slightly longer than thicker upper one.

Antennal peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing strong subdistal ventral spine; scale obsolete.

Mouthparts as figured; maxilliped 3 lacking epipod.

Epistomial projection broadly rounded in lateral view, spineless.

Chelipeds equal, moderately stout, articles spineless. Carpus trigonal, shallow longitudinal groove laterally, obsolescent spine or angle at anterior end of dorsal crest; dense plumose setae in dorsal and dorsomesial tract. Palm oval in cross section, length on female including fixed finger about 1.9–2.3 maximal height, stouter in male, fingers more extended in female than in male; prominent setae in row of scattered sparse tufts on upper mesial surface, more dense along low lateral ridge, much longer in ventral tract; mesial and lateral condyles of dactyl fairly prominent. Fixed finger about as long as dactyl, rather stout and gently curved; few tiny teeth on raised prehensile edge. Dactyl curved, setose, stouter than fixed finger, sometimes hooking beyond tip of opposed finger, and abruptly tapered to tip, crest of small teeth sometimes on cutting edge.

Leg 2 spineless, slender, merus reaching to cover base of antenna; carpus elongate; propodus and dac-

tyl tapering to acute tip. Legs 3 and 4 similar, successively shorter, with propodus not tapered but dactyl slender, both these articles setose, most dense laterally on propodus of 4, but line of granules less developed than in *U. cocosia*. Subchelate leg 5 reaching base of cheliped.

Two arthrobranchs arranged in biserial rows of undivided (entire) lamellae on maxilliped 3 and legs 1–4.

*Measurements (mm).*—Female, length anterior carapace 3.3, length carapace 6.4, length chela including fixed finger 3.2, height chela 1.4. Male, same, 3.1, 5.2, 3.2, 1.7.

*Type-locality.*—Puerto Escondido, Baja California Sur, Gulf of California.

*Remarks.*—Lockington (1878) based his description of two specimens “collected . . . under stones and coral at low tide. August 1876.” The types have not been seen since the original description was published, are presumably lost, and no other specimens which can be attributed to *U. rugosa* are known other than those reported above from nearby Bahía Agua Verde. They fit Lockington’s description as well as one could hope, and I have no hesitation in identifying them as his species.

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